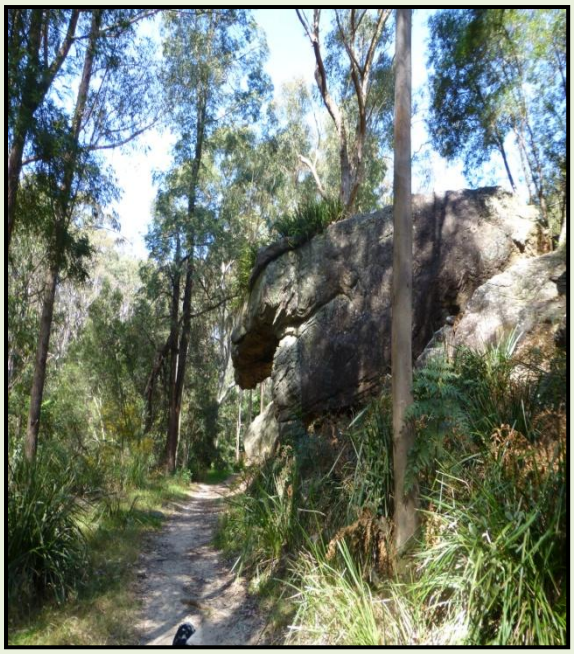

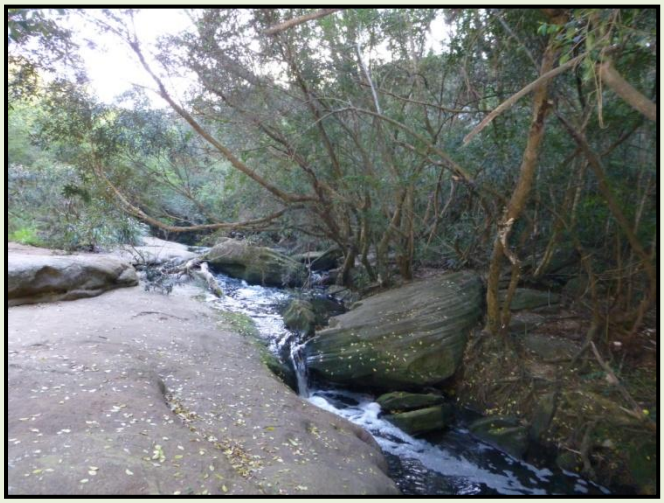

Technical Studies: flora & fauna investigations in support of a proposed Cycleway Link in the Cattai Creek Riparian Corridor between Linksley Avenue and Rosebery Road

Prepared for
The Hills Shire Council

28 September 2012

Prepared by
UBM Ecological Consultants Pty Ltd

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Executive Summary

Background

UBM Ecological Consultants has been commissioned by The Hills Shire Council to undertake Flora & Fauna Investigations in support of a proposed Cycleway Link in the Cattai Creek Riparian Corridor between Linksley Avenue Glenhaven and Rosebery Road at Kellyville. A substantial part of the proposed Cycleway Link is located through the valley of an unnamed eastern tributary of Cattai Creek, which joins into Cattai Creek to the north of Chainmail Crescent.

THSC is developing a system of Cycleways within The Hills Shire. This is an on-going project, and the current Cycleway Proposal is among a number of such Proposals planned for The Hills Shire over the next several years. The proposed Cycleway Links join into a number of existing pathways, and are expected to combine concrete pathway construction with reinforced wooden boardwalks.

The objective of the current Report is to provide information on the ecological resources of the Study Area in order to support a Review of Environmental Factors (REF) and inform an appropriate design for the Cycleway Link through the Cattai Creek Riparian Corridor. This REF is currently in preparation and when completed, will be presented under separate cover.

Results:

Flora: Vegetation mapping undertaken by Tozer *et al*. (2010)[1] for the former Department of Environment Climate Change & Water ('DECCW')[2] describes the vegetation in the Study Area as **Hinterland Sandstone Gully Forest** and **Sandstone Riparian Scrub** (see *Figure 2.2*). Smaller stands of Sydney Sandstone Gully Forest and Sydney Sandstone Ridgetop Woodland were also noted to occur close to the Study Area (UBM 2012). None of these plant communities are listed under the threatened species legislation (*TSC Act/EPBC Act*).

Tozer *et al.* (2010) also maps a small stand of **Sydney Turpentine Ironbark Forest** at the south-eastern end of the Study Area, near Linksley Road and Timber Grove. Another small area of STIF is mapped on the slopes below Ridgecrop Drive but this does not intrude into the current Study Area (see *Figure 2*.2. STIF is listed as an 'Endangered Ecological Community' ('EEC') under the NSW *TSC Act* and as 'Critically Endangered' under the Commonwealth *EPBC Act (see Appendix 3).*

Two (2) flora species listed under the TSC Act were recorded: ***Epacris purpurascens var. purpurascens*** and ***Darwinia biflora***. One (1) specimen of Brush Cherry (***Syzygium paniculatum***) was also recorded (*TSC Act* and *EPBC Act*), but given its location next to a residential garden, this is believed to be a horticultural planting or a garden escape (see *Figure 3.1*). The impacts of the proposed Cycleway Link on these threatened flora species have been assessed under Part 5(a) of the *Environmental Planning and Assessment Act* (**'the Seven-part Test'**), but no significant impact was recorded. Therefore it will not be necessary to apply to the Director General Environment and Heritage for the preparation of a Species Impact Statement for flora issues.

[1] Known as 'SCIVI' - Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tableland, in *Cunninghamia* 11 (3)

[2] DECCW is now the Office of Environment & Heritage ('OEH") within the Department of Premier & Cabinet

Fauna: By the completion of the current field survey (September 2012), 31 bird species, one (1) species of native frog, two (2) species of native reptile and six (6) mammals were identified within or adjacent to the Study Area.

The **Eastern Bentwing-bat** (***Miniopterus schreibersii oceanensis***) and **Little Lorikeet** (***Glossopsitta pusilla***) are listed as 'vulnerable' under the *TSC Act* and were identified during current field investigations (September 2012). It is possible that other threatened species recorded for the Region would utilise the resources of the Study Area or the neighbouring properties on occasion for foraging, hunting, nesting or roosting.

Under the precautionary principle, a **Seven-part Test of Significance** (see *Appendix 6*) for each of the following species has considered the impacts of the construction of the Cycleway Link from Linksley Avenue to Rosebery Road:

- Little Lorikeet (*Glossopsitta pusilla*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Powerful Owl (*Ninox strenua*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)

Each of the Seven-part Tests carried out for the species listed above have concluded that provided that the recommendations set out in this Report are followed, there will be no significant impact on any threatened fauna species. Therefore it will not be necessary to apply to the Director General Environment and Heritage for the preparation of a Species Impact Statement for fauna issues.

Cycleway construction methods along each of the three (3) sections of the proposed Cycleway Link route will vary, although it is expected that only construction on the 3rd section (from Chainmail Crescent to Rosebery Road) that is likely to have an impact on the surrounding vegetation.

Recommendations:

In considering the impacts of the construction of the Cycleway Link from Linksley Avenue to Rosebery Road, UBM recommends that:

- Wherever possible, clearing of native vegetation (bushland) to facilitate the construction of the Cycleway Link should be confined to the smallest area required for development given safety considerations and best practice cycleway design (i.e. 2.5 to 3 metres maximum)
- Bushland on either side of the bush track and fire trail should be subject to bush regeneration works or at the very least, to targeted weed control.
- Targeted weed control should be undertaken *prior to* commencement of works, with emphasis on the removal of noxious weeds. As the unnamed eastern tributary creek forms a small catchment starting at Linksley Avenue, a unique opportunity exists to control target weeds from the head of catchment down to its intersection with Cattai Creek.

- Fauna habitat should be maintained. Habitat (hollow-bearing) trees should be located prior to construction, marked (as per *Figure 3.2*) and protected during the construction phase.
- Weed debris and other rubbish generated by construction should be removed off-site to a designated landfill depot, and not left stockpiled along track edges.
- Future landscaping along the route should use only locally indigenous species. No areas of bare or disturbed soil are to be left following construction or this will encourage the establishment of weeds.

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Certification

I, Judith Rawling Managing Director of UBM Ecological Consultants Pty Ltd hereby state that the Flora and Fauna Investigations undertaken for the Cattai Creek Riparian Corridor between Linksley Avenue Glenhaven and Rosebery Road at Kellyville has been prepared in consideration of the schedules and requirements of *the* NSW *Threatened Species Conservation Act 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Survey methods conform to the '*Threatened Species and Regional Biodiversity Survey and Assessment Guidelines'* (DECC 2007). Reference has also been made to The Hills Shire Council's *Environmental Management Plan* (1997), *Generic Plan of Management for Natural Areas* (2008), and to other relevant plans and policies.

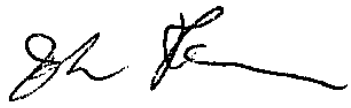
The UBM Ecological Consultants project team charged with preparing this Report were:

- Judith Rawling (BA,DipEd,DipEnvStud,MEnvSt)
- Rebecca Carman (BSc,MPhil,PGDipWldMgt)
- Garon Staines BAppSci

Disclaimer

The preparation of this Report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the Report. All findings, conclusions or recommendations contained within the Report are based only on the aforementioned circumstances.

The Report has been prepared for use by the Client THSC, and no responsibility for its use by other parties is accepted by UBM Ecological Consultants Pty Ltd.



Judith Rawling
Managing Director UBM Ecological Consultants
Member AIB, MESA, MEIANZ, Member Executive Council ECA (NSW)

Draft V1 28 September 2012

Definition of Terms

BHSC – formerly Baulkham Hills Shire Council, now The Hills Shire Council

Council/THSC – here, The Hills Shire Council

Ecological Community – an assemblage of species with 6 types of properties, composition; structure; habitat; distribution; interactions between their component species, and ecological processes and function (Keith 2009); and occupying a particular area at a particular time.

EEC – Endangered Ecological Community **–** as determined by the NSW Scientific Committee and described as–a community facing a risk of extinction in the immediate future, as listed under State and/or Commonwealth threatened species legislation

DECCW – NSW Department of Environment, Climate Change and Water (now the Office of Environment & Heritage under the Department of Premier and Cabinet)

Direct Impacts are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat.

Indirect Impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas.

EPBC Act – Commonwealth *Environment Protection & Biodiversity Conservation Act 1999*

Habitat – an area or areas occupied, or periodically or occasionally occupied by a species, population or ecological community, and including any biotic or abiotic components present.

HSGF – Hinterland Sandstone Gully Forest, an ecological community considered to be adequately conserved in the Sydney Bioregion

LGA – Local Government Area

Locality – generally, an area within 1-2 kilometres of the Study Area

Noxious Weed – a species gazetted for the LGA under the *Noxious Weeds Act 1995* (amended 2000)

NPWS – National Parks & Wildlife Unit of the Office of Environment & Heritage

OEH – Office of Environment & Heritage under the NSW Department of Premier and Cabinet (formerly DECCW)

SRS – Sandstone Riparian Scrub, an ecological community considered to be adequately conserved in the Sydney Bioregion

SCIVI – *Southeast NSW Native Vegetation Classification and Mapping,* by Tozer *et al.* 2010 for former NSW Department of Environment and Climate Change (DECCW)[3].

STIF – Sydney Turpentine Ironbark Forest, an ecological community considered to be 'Endangered' under the NSW *Threatened Species Conservation Act 1995*, and 'Critically Endangered' under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999*.

Study Area - means that part of the Study Area likely to be affected by the Proposal, either directly or indirectly. The Study Area extends as far as necessary to take all potential impacts of the development into account; in this case, three (3) to five (5) metres on each side of the proposed Cycleway Link, depending on topography and access.

THSC – the Hills Shire Council

TSC Act – NSW *Threatened Species Conservation Act 1995*

UBM – UBM Ecological Consultants Pty Ltd: formerly trading as Urban Bushland Management Consultants ('UBMC')

Vegetation Community – described as an assemblage of native flora species known to occur in association with each other as a result of topography, soil landscape and rainfall.

WoNS – Weed of National Significance (Commonwealth Listing)

[3] **Reference:** Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. & Pennay, C. (2010). Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tableland, in Cunninghamia 11 (3)

1 INTRODUCTION

1.1 BACKGROUND INFORMATION

UBM Ecological Consultants has been commissioned by The Hills Shire Council to undertake Flora & Fauna Investigations in support of a proposed Cycleway Link between Linksley Avenue Glenhaven and Rosebery Road at Kellyville.

THSC is developing a system of Cycleways within The Hills Shire. This is an on-going project, and the current Cycleway Proposal is among a number of such Proposals planned for The Hills Shire over the next several years. The proposed Cycleway Links join into a number of existing tracks and pathways, and are expected to combine concrete and decomposed granite pathway construction with reinforced wooden boardwalks in ecologically sensitive areas.

The **Study Area** is located in the Cattai Creek sub-catchment of the Greater Hawkesbury-Nepean Catchment in Western Sydney. Cattai Creek forms the boundary between the suburbs of Glenhaven (north-east), Castle Hill (south-west) and Kellyville (west) (see *Figure 1.1*).

A substantial part of the proposed Cycleway Link is located in the valley of an unnamed eastern tributary of Cattai Creek, which joins into Cattai Creek in Fullers Road Reserve to the north of Chainmail Crescent. Both waterways flow through steep sided gullies with native bushland occurring on the slopes throughout the Study Area. For the purposes of this Report, land along these two (2) watercourses will be described collectively as the *Cattai Creek Riparian Corridor*.

The local positioning of the Cattai Creek Riparian Corridor is shown on *Figure 1.1.* The proposed route of the new Cycleway Link is shown on *Figure 1.2.*

1.2 Report Objectives

The objective of the current Report is to provide information on the ecological resources of the Study Area in order to support a Review of Environmental Factors (REF) and to inform an appropriate design for the Cycleway Link in the Cattai Creek Riparian Corridor. This REF is currently in preparation and when completed it will be presented under separate cover.

The current Report assesses the conservation significance of the flora and fauna species and populations which potentially occur in the Study Area, Locality and Region in regards to the current State *Threatened Species Conservation Act* 1995 (‘*TSC Act*’) and Commonwealth *Environment Protection & Biodiversity Conservation Act* 1999 (‘*EPBC Act*’) environmental legislation.

Figure 1.1: Local Positioning of the Study Area in the Cattai Creek Riparian Corridor

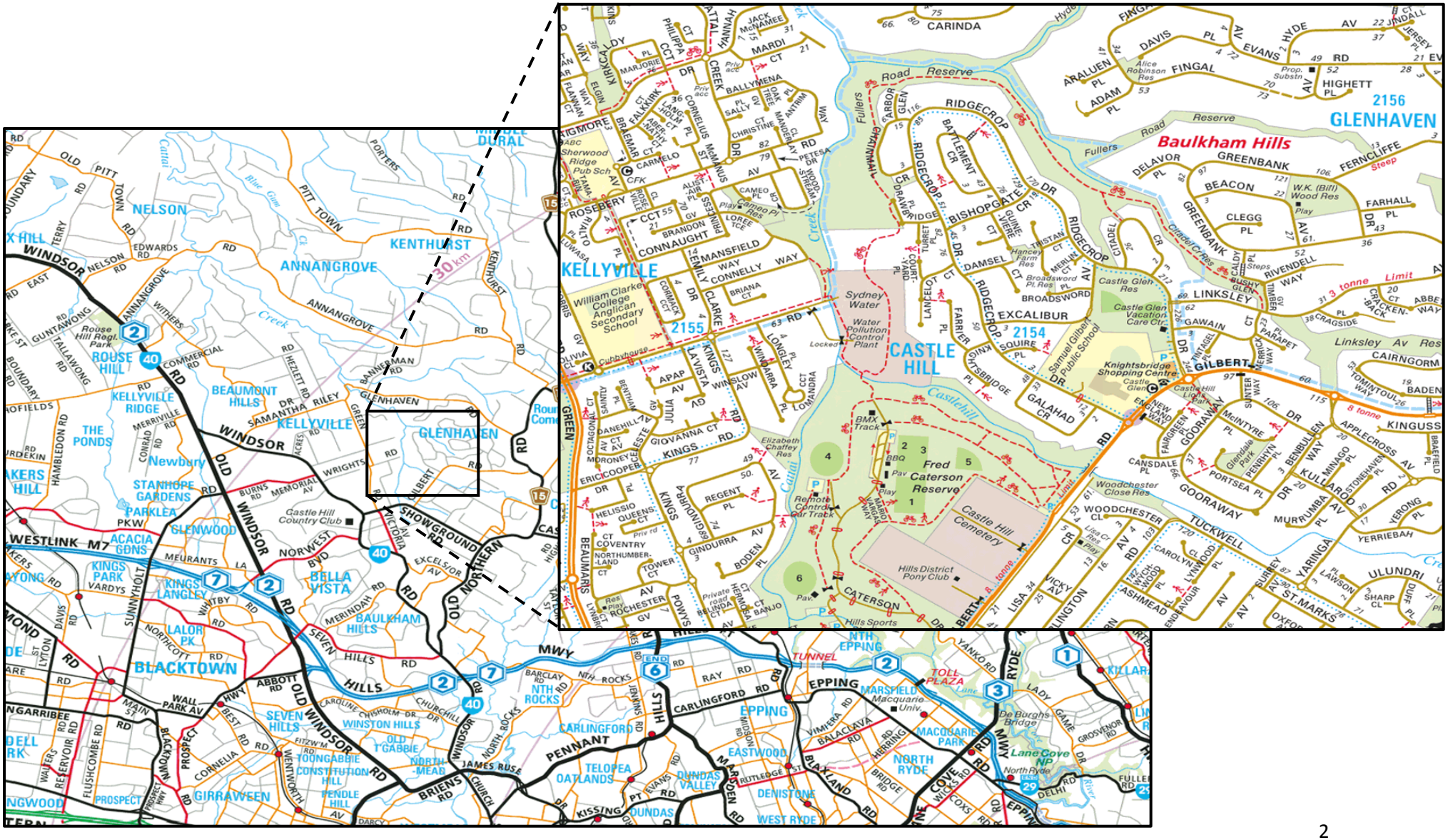
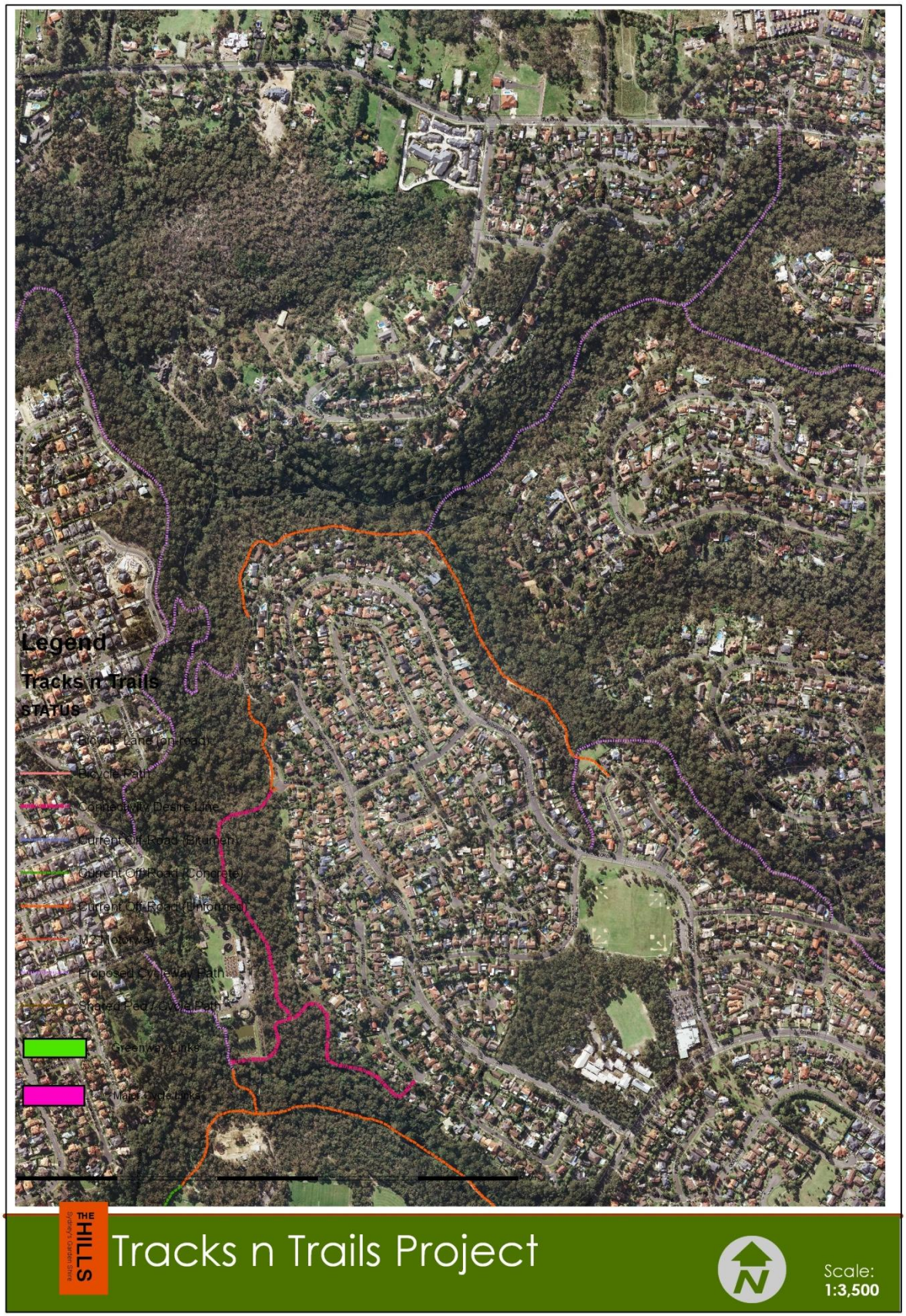


Figure 1.2: Proposed Route of Cycleway Links in the Cattai Creek Sub-catchment*



2 SITE DESCRIPTION

2.1 Location and Setting

The proposed route of the new Cycleway Link in the Cattai Creek Riparian Corridor utilises an existing bush track between Linksley Avenue to Citadel Crescent (hereafter '**Section 1'**), and a wide paved fire trail which runs between Citadel Crescent to Chainmail Crescent ('**Section 2'**).

The proposed Cycleway Link extends from the Chainmail Crescent fire trail to a narrow bush track, then follows a circuitous route down a steep embankment, ending at Cattai Creek opposite Rosebery Road, which is located on the ridgeline on the eastern side of the Creek ('**Section 3'**) (see *Figure3.2).*

The area surveyed varied in width between three (3) to five (5 metres) upslope and downslope of the existing bush track and fire trail, but in places access was limited by topography and private property boundaries.

Total length of the area surveyed for Sections 1 to 3 was approximately 1,906 linear metres (1.9 km).

NOTE: An additional area along a network of existing bush tracks from the end of Chainmail Crescent as far as the Sydney Water's Water Pollution Control Plant at the end of Wrights Road Kellyville was also surveyed ('**Section 4'**)**.** This area was surveyed in order to assess optional routes crossing over Cattai Creek, thus avoiding the need to create a high level bridge at Rosebery Road (see *Figure 3.2*).

Residential land in Glenhaven (north-northeast) and Kellyville (west) is located on both sides of the Cattai Creek Riparian Corridor, with private property boundaries backing onto the proposed Cycleway Link route for most of Sections 1 to 3 (Linksley Avenue to Chainmail Crescent).

A sewer line easement is located in Section 1 on the south side of the unnamed tributary creek, with manholes located along a signposted 'bush track' running from Linksley Avenue to Citadel Crescent. Connecting mains cross over to the opposite side of the gully (see *Plates*). It appears that the bush track has been located over the easement, which has then been backfilled with small rocks to create the rough bush track.

A large sewer pipe is located along the upper side of the track between Chainmail Crescent and Drawbridge Place. The Sydney Water Corporation ('SWC') Water Pollution Control Plant is located upstream on Cattai Creek, at the eastern end of Wrights Road (ex-Study Area). Two (2) footbridges cross over Cattai Creek on flat land near the Water Pollution Plant (see *Plates*).

2.2 Site Definition

Site Definition for the Study Area is provided in *Table 2.1.*

Table 2.1: Site Definition

TITLE INFORMATION	Cattai Creek Riparian Corridor
LOCATION	Linksley Avenue Glenhaven to Rosebery Road Kellyville
TOTAL AREA	1.8 ha (survey area 1800 m x 10 m)
TOPOGRAPHIC MAP	Riverstone 9030-1S
GRID REFERENCE	-33.707253 S centroid, 150.988473 E centroid
OWNERSHIP	The Hills Shire Council
LOCAL GOVERNMENT AREA	The Hills Shire
ZONING (The Hills draft LEP 2010)	RE1 Public Open Space
CURRENT LAND USE	Native bushland (passive recreation) bordering residential land

2.3 Physical Environment

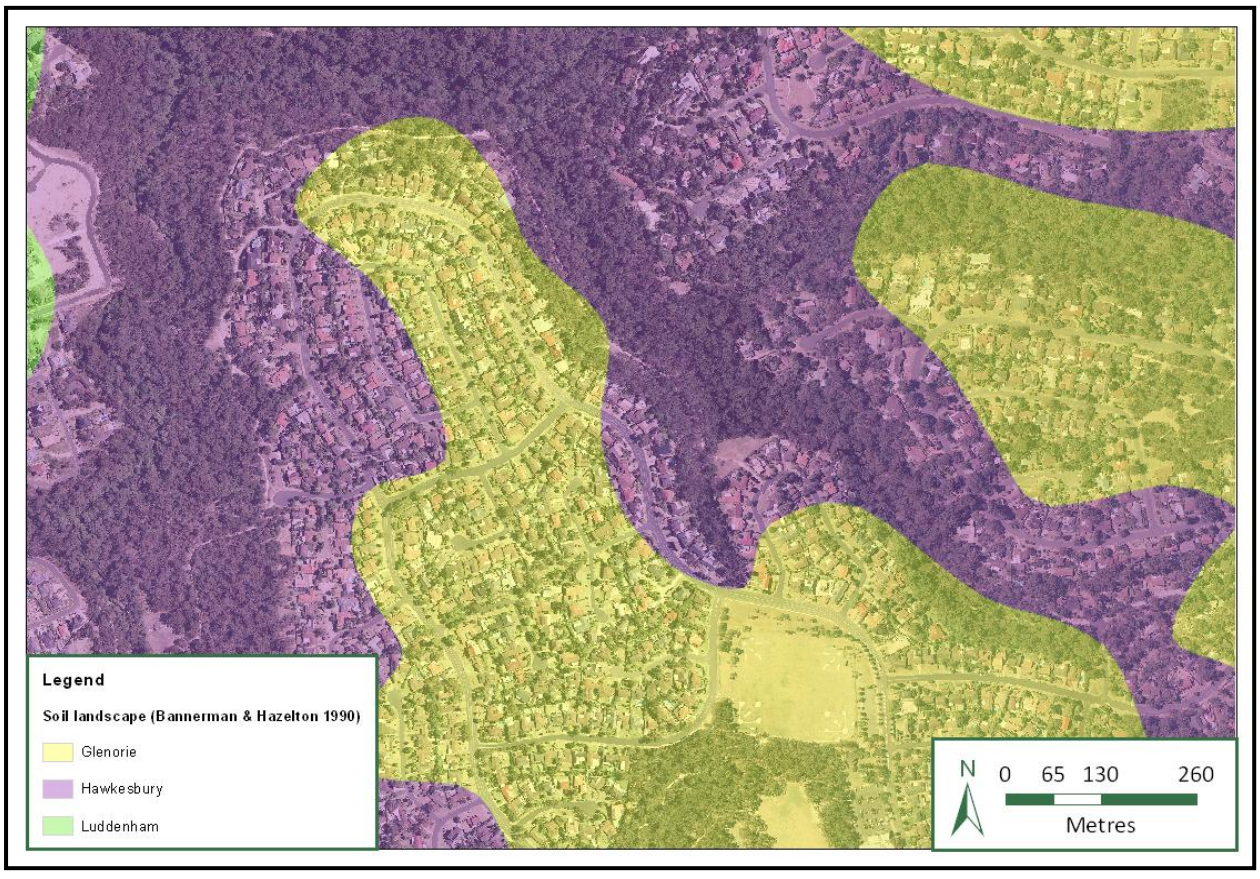
The physical characteristics of the Study Area and local environs are summarised in *Table 2.2*.

Table 2.2: Physical Features of the Study Area & Environs

FEATURE	DESCRIPTION
SOIL LANDSCAPE UNITS	The Study Area is dominated by the **Hawkesbury** (ha) Soil Landscape Unit with small areas of the **Glenorie** (gn) SLU also occurring (see *Figure 2.1).* Bannerman & Hazelton 1990). The Hawkesbury SLU forms a rugged landscape with rolling to very steep hills based on Hawkesbury Sandstone geology. Hawkesbury soils consist of shallow, medium to coarse grained quartz sandstones with minor shale and laminate lenses. They are subject to extreme soil erosion hazard, mass movement, steep slopes and rock outcrops and the soils are generally infertile and acidic. The Glenorie SLU forms a landscape dominated by undulating to rolling low hills on the Wianamatta Group Shales. Soils are generally shallow to moderately deep (<100 cm) on crests and upper slopes to deep (>200 cm) along drainage lines. Soils are subject to a high erosion hazard, localised impermeable highly plastic subsoil and like most shale-based soils they are moderately reactive once the protective vegetation cover is removed.
TOPOGRAPHY	The Hawkesbury SLU forms the steep rugged slopes and ridges of the Hornsby Plateau in the northern part of the Sydney Basin. Local relief is 40-22m, with slopes >25%. Large sandstone outcrops, floaters and benches with deeply incised valleys and steep side slopes are present. Small areas of Glenorie SLU are found in the north, centre and west of the Study Area (see *Figure 1.3*), being mainly 'fringe sites' where the landscape is less rugged, the valley less deeply incised and grading into a landscape of low

FEATURE	DESCRIPTION
	rolling low hills. Local landscapes generally conforms to this description, with the greater part of the survey area conforming to typical Hawkesbury topography.
LOCAL HYDROLOGY	The **Cattai Creek sub-catchment** is located in the Greater Hawkesbury-Nepean Catchment. The major part of the proposed Cycleway Link is located on an unnamed eastern tributary of Cattai Creek, which joins into Cattai Creek to the north of Chainmail Crescent. For the purposes of this Report, together these two (2) watercourses will be described as the **Cattai Creek Riparian Corridor**.
CLIMATIC DETAILS	The mean daily maximum temperature is 28.4°C, with the highest temperatures recorded in December and January. The mean daily minimum temperature is 4.5°C, with the lowest temperatures recorded in June and July. Mean annual rainfall is 114.7 mm; with January, February and March recording the highest mean rainfall (Bureau of Meteorology 2012, #067026 Seven Hills (Collins Street)

Figure 2.1: Soil Landscapes (Bannerman & Hazelton 1990)



2.4 Biological Environment

Vegetation Communities

Vegetation mapping by Baulkham Hills Shire Council (2005) describes the vegetation in the Study Area as 'Sandstone Gully Forest' with vegetation along the creekline supporting a 'rainforest-type' understorey. This mapping program has now been superseded by other workers (Tozer *et al* 2006/2012, SMCMA draft 2010) and in some cases nomenclature has been changed.

Vegetation mapping undertaken by Tozer *et al*. (2010)[4] for the former Department of Environment Climate Change & Water ('DECCW')[5] describes the remnant vegetation in the Study Area as **Hinterland Sandstone Gully Forest** ('HSGF') and **Sandstone Riparian Scrub** ('SRS'*)* (see *Figure 2.2*).

Both HSGF and SRS are considered to be adequately represented in conservation reserves in the Sydney Basin Bioregion and are currently NOT listed under the threatened species legislation (*TSC Act/EPBC Act*). Descriptions of the HSGF and SRS after Tozer *et al.* (2006/2010) have been included *Appendix 1* and *2* respectively.

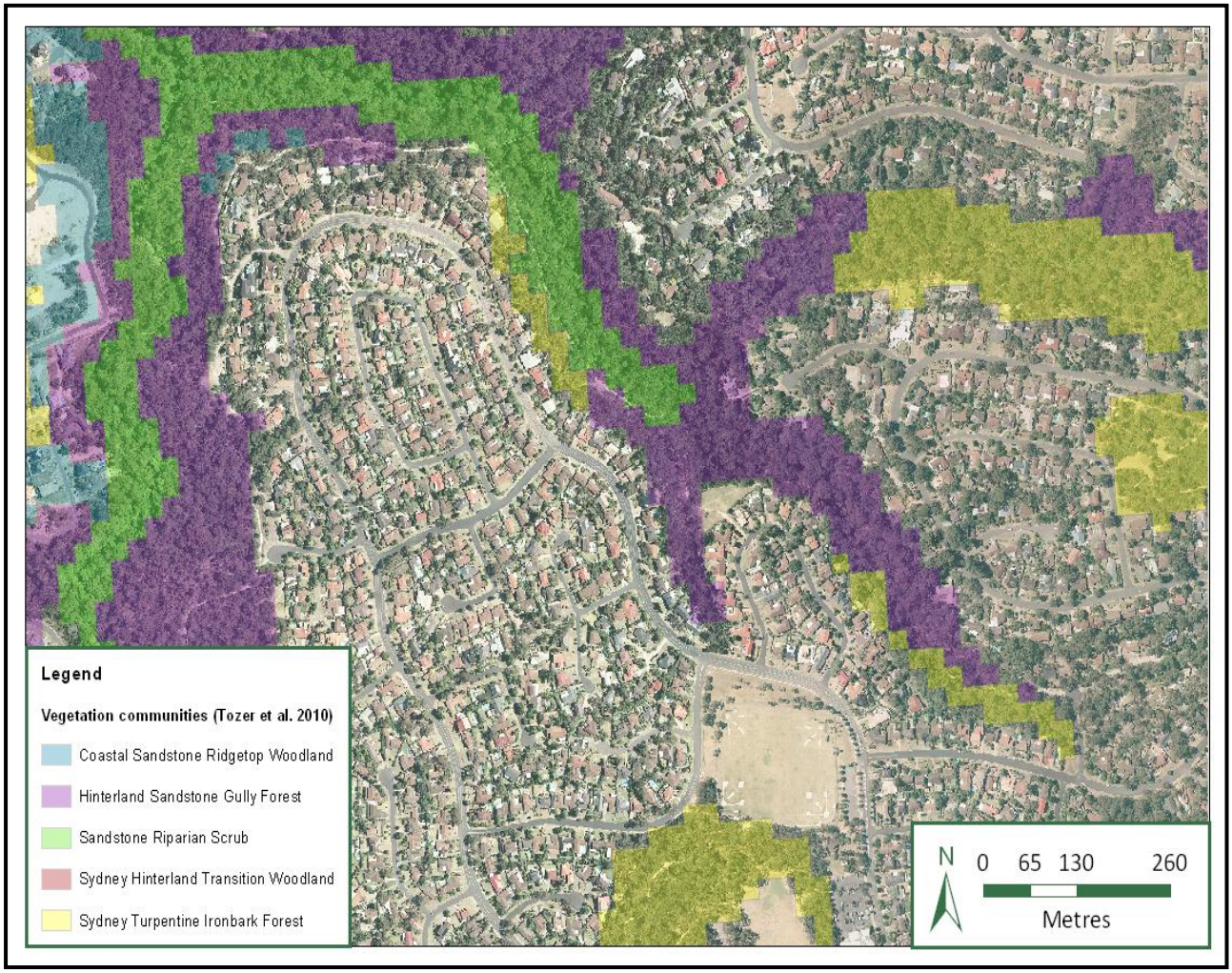
Tozer *et al.* (2010) also maps an area of **Sydney Turpentine Ironbark Forest** ('STIF') at the south-eastern end of the Study Area near Linksley Road and Timber Grove. Another small area of STIF is mapped on the upper slopes below Ridgecrop Drive, but this does not intrude into the current Study Area (see *Figure 2.2*). STIF is listed as an '**Endangered Ecological Community'** ('EEC') under the NSW *TSC Act* and as '**Critically Endangered'** under the Commonwealth *EPBC Act* (see *Appendix 3*).

The Tozer vegetation mapping is based on local geology and soil type, with limited ground truthing; so it is possible that a detailed site survey will modify this community designation. Site investigations September 2012 generally concurs with the mapped nomenclature, however for the purposes of this Report detailed flora investigations have been undertaken to ground truth previous vegetation mapping (see *Section 3.2.4).*

[4] Known as 'SCIVI' - Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tableland, in *Cunninghamia* 11 (3)

[5] DECCW is now the Office of Environment & Heritage ('OEH") within the Department of Premier & Cabinet

Figure 2.2: Native Vegetation Communities Mapped for the Study Area (Tozer *et al.* 2010)



2.5 LEGISLATIVE CONTEXT

Comments and assessments within this Report are based on the requirements of the *Environmental Planning and Assessment Act 1979* – with consideration given to the principals of Ecologically Sustainable Development, NSW *TSC Act,* and Commonwealth *EPBC Act*.

Table 2.3 provides a summary of policies, local planning and legislative requirements applicable to the Study Area and the current Proposal.

Table 2.3: Summary of Local Planning Policies & Legislative Requirements

GOVERNMENT LEVEL	RELEVANT POLICY /LEGISLATION	RELEVANCE TO STUDY AREA
LOCAL	*draft Hills Local Environmental Plan 2010*	Bushland in the Study Area is zoned RE1 – Public Open Space (formerly 6(a) Open Space)
	Environmental Management Plan (October 1997).	The EMP provides an integrated approach to managing the Shire's natural and built environment. The EMP commits Council to the primary tenets of ecologically sustainable development, being: the precautionary principle; intra-generational equity; inter-generational equity, and the conservation of biological diversity.
	Plan of Management for Natural Areas (December 2008	Provides a 'generic' management plan for all community land categorised as 'Natural Areas' in terms of the *Local Government Act 1993*. This Plan focuses on the allocation of Council's existing natural area management resources and has been prepared to consider issues identified in Council's EMP (1997). The Plan applies to bushland owned by Council and to bushland on Crown Land under Council's care and control. As plans of management become available for individual reserves, it is understood that the generic Plan will be updated.
	Threatened Species Conservation Act 2012	One (1) small stand of Sydney Turpentine Ironbark Forest (STIF) occurs near Linksley Avenue/Timber Grove at Glenhaven (see *Figure 2.3*). STIF is an endangered ecological community (EEC) under the *TSC Act.* Flora species: - *Epacris purpurascens* var. *purpurascens* and *Darwinia biflora* were recorded *(see Figure 3.1).* One (1) *Syzygium paniculatum is* also present but is likely to be a horticultural planting. Fauna species - two (2) fauna species listed under the *Act* were recorded in the Study Area - the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Little Lorikeet (*Glossopsitta pusilla*).

GOVERNMENT LEVEL	RELEVANT POLICY /LEGISLATION	RELEVANCE TO STUDY AREA
		Other listed fauna are likely to utilise the resources of the Study Area on occasion.
	Noxious Weeds Act 1993 *(Amended 2005)*	At least eight (8) noxious weeds listed for Hawkesbury River County Council (of which THSC is a constituent member) were recorded in the Study Area (see *Table 3.2*)
	Rural Fires Act 1997 / Amendment 2002	Core Bushland in the Study Area is classified as Category 1 Bushfire Prone Land, with adjoining residential land classified as Vegetation Buffer 100 and 30 metres (Hills Bushfire Prone Lands Map Sheet 6, 2012)
COMMONWEALTH	*Environment Protection and Biodiversity Conservation Act 1999*	One (1) small stand of Sydney Turpentine Ironbark Forest (STIF) is found near Linksley Avenue/Timber Grove (see *Figure 2.2*). STIF is a 'critically endangered ecological community' (CEEC) under the *EPBC Act.* Flora species: One (1) *Syzygium paniculatum* (V) is present but the specimen is likely to be a horticultural planting. Fauna species: No flora or fauna No flora or fauna species or populations listed under the *EPBC Act* were recorded for the Study Area.

3 FLORA ASSESSMENT

The flora assessment was undertaken to determine the ecological communities occurring within and adjacent to the Study Area and to describe the current status of the indigenous vascular vegetation present. The conservation value of the vegetation in the National, State and regional context has been considered in relation to vegetation community types and flora species present.

3.1 METHODS

3.1.1 Literature Review

During the preparation of this Report, relevant databases and other studies were accessed, including previous studies and investigations for the Locality.

The main documents referenced were:

- *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands* (Tozer, *et al*. for DECCW 2006/2010); and
- *Flora and Fauna Studies and Reviews of Environmental Factors for Cycleway Links on Smalls, Caddies, Cattai and Strangers Creeks* (UBM for THSC, various dates)

In addition, the Commonwealth *EPBC Act* Online Database (SEWPAC 2012; search area five [5] km radius around the Study Area coordinates (-33.707253 S centroid, 150.988473 E centroid) and the NPWS *Atlas of New South Wales Wildlife Database* (DECCW 2012; search area 10 km x 10 km centred on the Study Area) were accessed to identify previous recordings of flora species of conservation significance within the Region.

3.1.2 Flora Field Survey

Site inspections were undertaken by Restoration Ecologist Judith Rawling, Field Ecologist Rebecca Carman on two (2) occasions in early September, and then by Consultant Ecologist Garon Staines on 17th September 2012. Approximately 18 hours was spent on site.

The vegetation within the Study Area was first assessed on foot using the 'Random Meander' method as described by Cropper (1993).

Using the 'Parallel Line' Method as described by Cropper (1993), a targeted search was then undertaken within the Study Area for all threatened species listed under the Schedules of the NSW *TSC Act* and/or the Commonwealth *EPBC Act* which have been identified as occurring, or potentially occurring, in the Locality and Region (see *Table 3.1*). This method is undertaken using a series of parallel line transects along the proposed corridor of each option. All vascular flora species located during the 'Parallel Line' searches were recorded. Any noxious weeds or keystone environmental species located were also recorded.

The native vegetation located adjacent to the proposed route of the proposed Cycleway Link was assessed for a distance of three (3) to five (5) metres on each side of the existing tracks and fire trail in order to determine whether any vegetation communities or flora species adjoining the site were of conservation significance. Where private property boundaries were located within the survey area upslope, or by steep topography downslope of the proposed route, searches were constrained.

The diversity of the species recorded during the current survey is expected to be influenced by seasonal factors, with some species likely to be inconspicuous, or absent from the above ground population during particular times of the year. This is particularly true of terrestrial orchids, which can persist for extended periods as dormant underground tubers. However, as the search was carried out in early spring when many native species were in flower, for the purposes of these investigations the survey effort was considered to be adequate.

Limitations

Most parts of the Study Area were accessible on foot other than a few areas where private property boundaries constrained access on the uphill side of the footpath/fire trail. Steep slopes on the lower (creek-side) of the proposed route also provided some limitations to survey; this especially being the case in the deep gully closest to Rosebery Road.

3.2 RESULTS

3.2.1 Flora Species

A total of 156 species was recorded for the Study Area. Of this number, 125 species recorded (~80 %) are locally indigenous (native) species, while the remainder were either weeds or horticultural introductions (see *Appendix 4* for a list of flora species recorded).

NOTE that the flora list presented in *Appendix 4 is* not meant to be a list of all species occurring in the Study Area, but represent only those species identified while searching for rare or threatened flora (as determined under the Schedules of the *TSC* and *EPBC Acts*).

3.2.2 Threatened Species

A database search (OEH 2012, SEWPAC 2012) provided a list of 16 flora species known to occur in the Study Region and listed under the NSW *TSC Act 1995* and/or Commonwealth *EPBC Act 1999*. This list is provided in *Table 3.1,* below.

Table 3.1: Flora Species of Conservation Significance Occurring within Locality and Region

SOURCE OF RECORDS

NSW BioNet (OEH 2012). Search area: 10 x 10 km centred on the Study Area

SCIENTIFIC NAME	COMMON NAME	LEGAL STATUS		RECORDS
		TSC ACT	EPBC ACT	
Hibbertia superans		E1	-	41
Tetratheca glandulosa	Black-eyed Susan	V	V	15
Epacris purpurascens var. purpurascens		V	-	153
Leucopogon fletcheri subsp. fletcheri		E1	-	25
Acacia bynoeana	Bynoe's Wattle	E1	V	12
Acacia gordonii		E1	E	1
Acacia pubescens	Downy Wattle	V	V	12
Darwinia biflora		V	V	259
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	5
Eucalyptus scoparia	Wallangarra White Gum	E1	V	1
Eucalyptus sp. Cattai		E1		22
Melaleuca deanei	Deane's Paperbark	V	V	1
Syzygium paniculatum	Magenta Lilly Pilly	E1	V	4
Persoonia hirsuta	Hairy Geebung	E1	E	15
Persoonia mollis subsp. maxima		E1	E	1
Pimelea curviflora var. curviflora		V	V	12

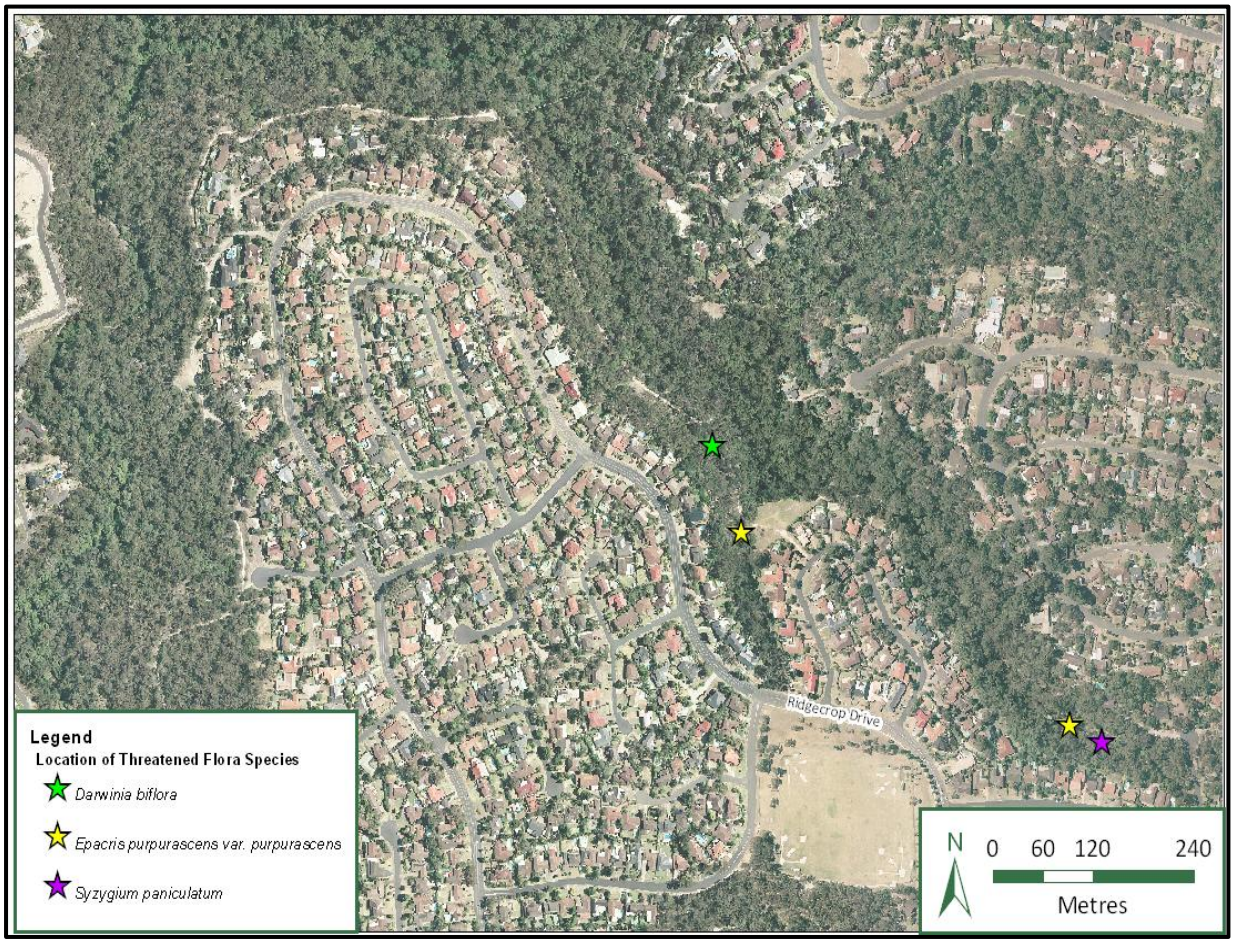
Two (2) naturally occurring species of conservation significance were recorded within the Study Area: ***Epacris purpurascens* var. *purpurascens*** and ***Darwinia biflora*.** Both species are listed as 'Vulnerable' (V) under the *TSC Act.*

A third species **Brush Cherry (*Syzygium paniculatum)*** was also found, but this is thought to be a horticultural planting (see *Figure 3.1*). Brush Cherry is listed under both the *TSC Act* (E1) and *EPBC Act (*V)

No other flora species listed under the NSW *TSC Act 1995* or Commonwealth *EPBC Act 1999* (per *Table 3.1*) was recorded in the Study Area during the floristic survey.

Plate 1: *Darwinia biflora* (source DEC 2004) and *Epacris purpurascens* var. *purpurascens*

Figure 3.1: Location of Threatened Flora Species in the Study Area



3.2.3 Introduced Species

Although the bushland is in relatively good condition overall (see *Section 3.2.3*), weeds are present along the creeklines, where tracks and fire trails are located in close proximity to residential development, and at entry/exit points to local roads.

At least eight (8) noxious weeds' were recorded, these being plants gazetted for The Hills Shire under the *Noxious Weeds Act 1993/1995*) (see *Table 3.2*). Of these, three (3) species are also declared as Weeds of National Significance ('WoNS').

Large stands of the noxious woody weed Privet are found on Cattai Creek near the site of the proposed bridge crossing and below a stormwater outlet on the slopes below Rosebery Road (Section 3). Scattered Privet and the occasional Lantana are found on both watercourses.

A number of environmental weeds or ruderal species (i.e. weeds of disused or vacant land) occur, these being herbaceous annuals such as Fleabane (*Conyza bonariensis*), Cat's Ear (*Hypochoeris radicata*), Plantain (*Plantago lanceolata*) and Fireweed (*Senecio madagascariensis*), while some of the horticultural plantings made by earlier landowners have spread into bushland (e.g. Silky Oak *Grevillea robusta*, *Jacaranda mimosifolia*) (see *Appendix 4* for a list of flora species recorded in the Study Area).

Table 3.2: Noxious Weed Species recorded for the Study Area

FAMILY	BOTANICAL NAME	COMMON NAME	NOXIOUS WEED CLASS
Asparagaceae	*Asparagus asparagoides**	Bridal Creeper	Class 4; WoNS
Asteraceae	*Ageratina adenophora**	Crofton Weed	Class 4
Solanaceae	*Cestrum parqui*	Green Cestrum	Class 3
Poaceae	*Cortaderia selloana*	Pampas Grass	Class 3
Verbenaceae	*Lantana camara*	Lantana	Class 4; WoNS
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	Class 4
Oleaceae	*Ligustrum lucidum*	Large-leaf Privet	Class 4
Rosaceae	*Rubus fruticosus* spp agg.	Blackberry	Class 4: WoNS

Actions Required For Noxious Weed Classes

1 The plant must be eradicated from the land and the land must be kept free of the plant

2 The plant must be eradicated from the land and the land must be kept free of the plant

3 The plant must be fully and continuously suppressed and destroyed

4 The growth and spread of the plant must be controlled according to the measures specified in a management plan* published by the local control authority and the plant may not be sold, propagated or knowingly distributed

5 The requirements in the Noxious Weeds Act 1993 (as amended 2005) for a notifiable weed must be complied with

As the land manager, THSC is required under the *Noxious Weeds Act 1993* (as Amended 2005) to control all noxious weeds on their own land, and to prevent their spread to adjoining properties. Council (through HRCC) is also required to enforce the Act on private property within the Shire.

NOTE ***a** regional weed management plan has been prepared for Privet species (Northern Sydney and Blue Mountains Regional Weeds Committee), which requires the relevant LCA to undertaken Privet control under item #4 above.

Weeds considered to be (Keystone) Environmental Weeds in the Sydney Region are listed in *Table 3.*3

Table 3.3: Keystone Environmental Weed Species recorded within the Study Area

FAMILY	BOTANICAL NAME	COMMON NAME
Aceraceae	*Acer negundo*	Sycamore Maple
Liliaceae	*Asparagoides aethiopicus*	Ground/Fern Asparagus
Apocynaceae	*Araujia sericifera*	White Moth Vine
Caprifoliaceae	*Lonicera japonica*	Honeysuckle
Commelinaceae	*Tradescantia fluminensis*	Wandering Jew
Davillaceae	*Nephrolepis cordifolia*	Fishbone Fern
Lauraceae	*Cinnamomum camphora*	Camphor laurel
Sapindaceae	*Cardiospermum grandiflorum*	Balloon Vine
Fabaceae	*Senna pendula* var. *glabrata*	Senna/Arsenic Bush
Poaceae	*Ehrharta erecta*	Perennial Veldt Grass
Poaceae	*Eragrostis curvula*	African Love Grass

3.2.4 Vegetation Communities

Plant Community 1 (see Figure 3.2)

Summary: Shrubby Open Forest to Forest 25-30m high Turpentine *Syncarpia glomulifera* and Smooth-barked Apple *Angophora costata*

Status: probably part of the *Sydney Turpentine Ironbark Forest* ('STIF') which is listed as 'endangered' in NSW (*TSC Act*) and as 'critically endangered' nationally (*EPBC Act*)

Threatened species present: none detected

Structure:

Trees (to 25-30m high): Turpentine *Syncarpia glomulifera* and Smooth-barked Apple *Angophora costata* and a smaller numbers of Blackbutt *Eucalyptus pilularis*,

Small trees (to 10m high): Turpentine *Syncarpia glomulifera*

Ground covers: Soft Bracken *Calochlaena dubia,* Fishbone Fern *Nephrolepis cordifolia**, Wandering Jew *Tradescantia fluminensis **

Climbers: none noted

Location: between WP406 & WP407 at Linksley Road / Timber Grove intersection (along narrow incised gully of unnamed eastern tributary)

Plant Community 2 (see Figure 3.2)

Summary: Shrubby Open Forest to 25m high to Tall Open Forest (30m+) of Blackbutt *Eucalyptus pilularis,* Sydney Peppermint *Eucalyptus piperita* and Yellow Bloodwood *Corymbia eximia*

Status: not listed as threatened in NSW or nationally. Does not fit cleanly into any native vegetation community described by Tozer *et al*. (2010) or DECCW (2009), although it could be an undescribed variant of *Hinterland Sandstone Gully Forest* (Tozer *et al*. 2010) as trees such as Blackbutt, Yellow Bloodwood and Sydney Peppermint are all positive diagnostic species in that community

Threatened species present:

Epacris purpurascens var. purpurascens (1 individual noted on edge of track (south side) at WP404; another 2 individuals noted at WP405 one being on edge of track (south-side), the other being further back. Both low growing to 0.5m and tangled in undergrowth. All specimens are marked with orange flagging tape (see *Figure 3.1*).

Syzygium paniculatum (1 possible individual to 6m high and DBH 150mm noted on track (north side) at WP406. Positive identification will depend on fruit being available. This specimen is likely to be a horticultural planting. Location is marked with orange flagging tape (see *Figure 3.1*).

Structure:

Trees (to 25-30m+ high): Blackbutt *Eucalyptus pilularis*, Sydney Peppermint *Eucalyptus piperita* & Yellow Bloodwood *Corymbia eximia*

Small trees (to 10m high): *Acacia binervia, Allocasuarina littoralis, Banksia serrata*

Shrubs: *Astrotricha longifolia, Grevillea speciosa, G. buxifolia*

Ground covers: *Entolasia stricta*

Climbers: *Clematis glycinoides, Pandorea pandorana, Hardenbergia violacea*

Location: between waypoints 396 (end of Arbor Glen) to WP398, WP403-406 (along incised gully)

Plant Community 3 (see Figure 3.2)

Summary: Open Scrub to Low Forest to 8-10m high of Water Gum *Tristaniopsis laurina*

Status: not listed as threatened in NSW or nationally. Probably *Sandstone Riparian Scrub* of Tozer *et al.* (2010)

Threatened species present: none detected

Structure:

Trees (to 10m high): Sydney Peppermint *E. piperita*, Water Gum *Tristaniopsis laurina*

Small trees (to 4m high): *Callistemon citrinus*

Shrubs (to 1m high): *Austromyrtus tenuifolia*

Location: As a narrow band along the rocky sections of Cattai Creek

Plant Community 4 (see Figure 3.2)

Summary: Shrubby Open Forest to 25m high of Sydney Peppermint *Eucalyptus piperita* & Scribbly Gum *Eucalyptus racemosa* / *E. sclerophylla* com

Status: not listed as threatened in NSW or nationally. Possibly forms an ecotone with communities 1 & 2.

Threatened species present: none detected

Structure:

Trees (to 25m high): Sydney Peppermint *Eucalyptus piperita* & Scribbly Gum *Eucalyptus racemosa* / *E. sclerophylla* complex

Small trees (to 10m high): *Ceratopetalum gummiferum, Ligustrum spp*, Acacia decurrens, Angophora bakeri*

Ground covers: *Tradescantia fluminensis **

Climbers: *Cardiospermum grandiflorum **

Location: between waypoints 388-393 (along main creek west (Cattai Creek) and south to the Water Pollution Control Plant.

Plant Community 5 (see Figure 3.2)

Summary: Shrubby Open Forest to 25-30m high of Sydney Peppermint *Eucalyptus piperita*

Status: not listed as threatened in NSW or nationally. Probably a variant of *Hinterland Sandstone Gully Forest* (Tozer *et al.* 2010)

Threatened species present: none detected

Structure:

Trees (to 25-30m high): Sydney Peppermint *Eucalyptus piperita*

Small trees (to 10m high): *Banksia serrata*, *Ceratopetalum gummiferum*

Shrubs (to 1-3m high): *Acacia longifolia ssp longifolia*, *Bossiaea obcordata*, *Dillwynia retorta, Banksia spinulosa,*

Ground covers: *Caustis flexuosa, Entolasia* spp*, Lepyrodia scariosa*

Climbers: few to no climbers

Location: between waypoints 386-387 (head of drainage line), and from WP385 north along edge of track from Drawbridge Place to WP395 (where Yellow Bloodwood C*orymbia eximia* becomes subdominant) to WP396, WP 398-399 (from here *Angophora costata* becomes co-dominant with Sydney Peppermint and Yellow Bloodwood), WP402-403

Plant Community 6 (see Figure 3.2)

Summary: Scrubby to Grassy Woodland to 20m high of Scribbly Gum *Eucalyptus racemosa* / *E. sclerophylla* complex, Thin-leaved Stringybark *E. eugenioides* and/or Yellow Bloodwood *Corymbia eximia*

Status: not listed as threatened in NSW or nationally. Possibly an undescribed variant of *Sydney Sandstone Ridgetop Woodland* ('SSRW') (Tozer *et al*. 2010)

Threatened species present:

Darwinia biflora (WP400) –an estimated population of about 50 individuals on southwest side of track as shown to me by Council officer 'Troy' of APZ crew. All plants appeared to be growing back off the track by a few metres: none were noted on track edges, although an old bit of yellow tape was pointed out, but none were found there during current survey. Location marked location with orange flagging tape (see *Figure 3.1*)

Epacris purpurascens var. purpurascens (1 individual noted on edge of track at WP401 – just to north of, and before open grassy area off Citadel Crescent on the western side of track near concrete drainage line pad. Location marked with orange flagging tape (*see Figure 3.1*).

Structure:

Trees (to 20m high): Scribbly Gum *Eucalyptus racemosa* / *E. sclerophylla* complex & Thin-leaved Stringybark *E. eugenioides*

Small trees (to 10-15m high): *Acacia binervia*, *Angophora bakeri*

Shrubs (to 2-4m high): *Kunzea ambigua, Leptospermum trinervium, Petrophile pulchella, Calytrix tetragona, Banksia spinulosa*

Ground covers: *Eragrostis curvula *, Entolasia stricta, Lepyrodia scariosa*

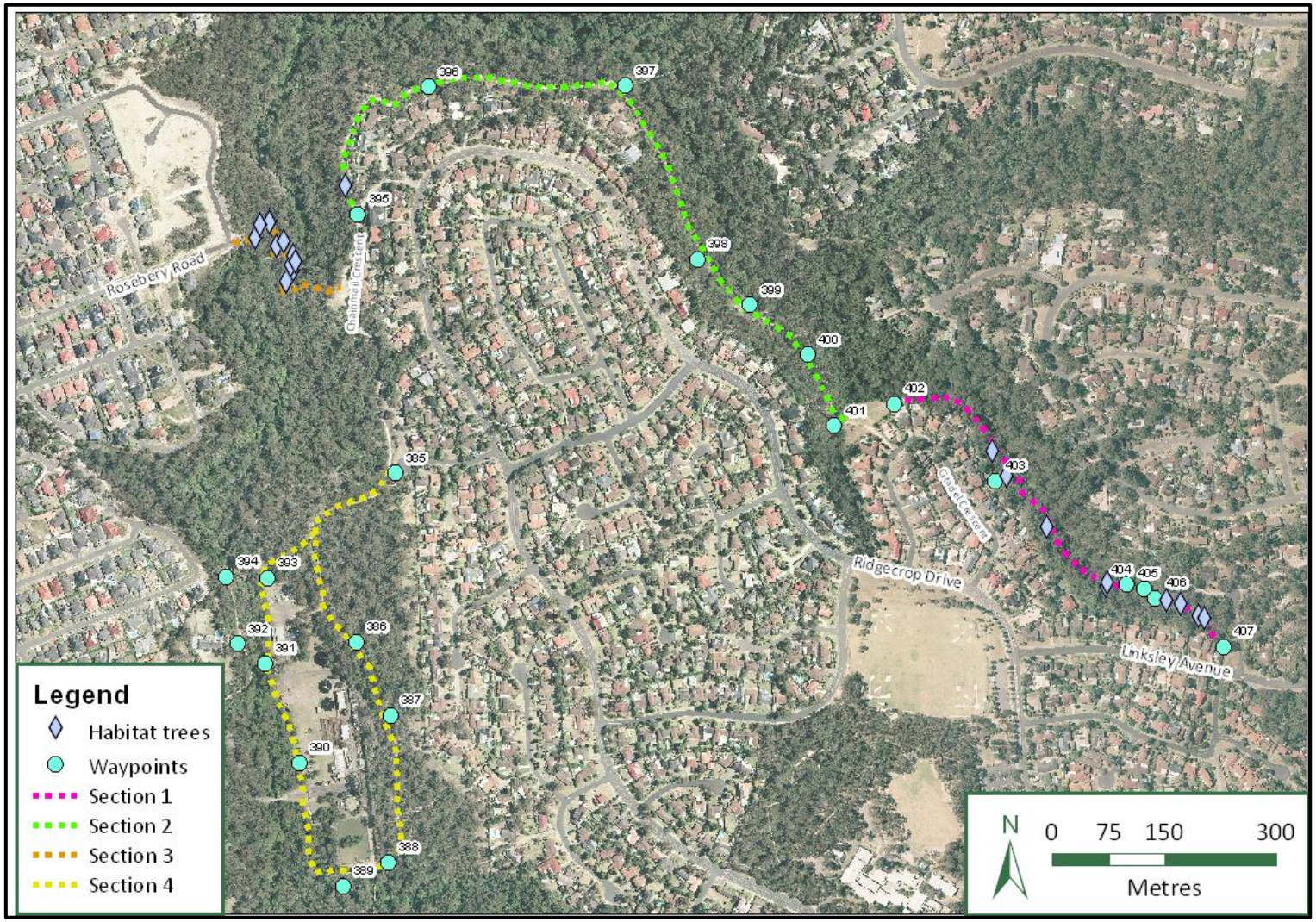
Climbers: few to no climbers

Location: between waypoints 385-386, 387-388, 393-385, WP399-401. Here, trees such as Yellow Bloodwood are co-dominant with the Scribbly Gum complex and with fewer Stringybark.

3.2.5 Habitat Trees

A number of habitat (hollow-bearing) trees were located within a few metres of the tracks and fire trail (see *Plates*). The location of hollow-bearing or other potential habitat trees was recorded using a handheld GPS and marked on a site map (see *Figure 3.2*).

Figure 3.2: Plan of Proposed Cycleway Link Route showing Sections 1-4 (as surveyed)



3.3 FLORA ASSESSMENTS OF SIGNIFICANCE

The *TSC Act* aims to conserve threatened species, populations, ecological communities and their habitats; to promote their recovery; and manage the processes that threaten or endanger them. Threatened species are listed under Schedules 1 and 2 of the Act, while communities considered 'at risk of extinction' are listed as endangered ecological communities ('EECs') under Part 3, Schedule 1.

Under the terms of the legislation, Local Government must assess the impacts of any proposed activity which might adversely impact on the EEC or any threatened species or populations, and where these are likely to occur, must identify strategies to minimise any such impacts. Further, development on adjoining land may also have a significant impact on the bushland's natural values, so that such activities must be carefully assessed by the Consent Authority (here HSC) prior to development consent being granted.

Under Section 5A of the *EP&A Act*, any development activity impacting on a species, population or ecological community listed under the *TSC Act* requires the application of an "Assessment of Significance". As well, listings under the Commonwealth *EPBC Act* require are subject to a similar Assessment process.

An Assessment of Significance (commonly called '**the Seven-part Test'**) is designed to determine *"whether there is likely to be a significant effect on threatened species, populations, ecological communities or their habitats"* (as listed on the Schedules of the NSW *TSC Act*), and consequently, to determine whether a Species Impact Statement is required.

In order to determine whether further studies are required, a search of the relevant ecological databases is required in order to identify those ecological communities, threatened species or populations known for the Locality and Region. This is followed by a comprehensive site survey to determine the presence, or potential presence of any threatened entities.

The field investigations undertaken provide the required ecological studies. Results of those investigations are presented in *Section 3.2* (flora) and *Section 4.3* (fauna) of this Report. The decision whether or not to apply the Seven-part Test has been made with respect to the outcomes of these investigations.

Assessments Required: The Proposal to develop a cycleway link may potentially impact in a minor way on a small stand of **Sydney Turpentine Ironbark Forest** ('STIF') near Linksley Avenue and Timber Grove (see *Figure 2.2*). STIF is listed as an EEC under the *TSC Act,* so it will therefore be necessary to undertaken the Seven-part Test to determine the impacts of the Cycleway Proposal on this EEC. As the STIF is also listed under Commonwealth legislation (*EPBC Act*), an Assessment may be required in accordance with Commonwealth's *Significant Impact Guidelines* (Department of the Environment & Heritage 2006).

Seven part tests have been for the naturally occurring ***Epacris purpurascens* var. *purpurascens*** and ***Dillwynia biflora***. See *Appendix 5* for Assessments of Significance. An Assessment of Significance has *not* been prepared for *Syzygium paniculatum* (Brush Cherry) as the specimen recorded is thought to be a horticultural introduction or garden escape.

4 FAUNA ASSESSMENT

4.1 Overview

The Study Area consists of the vegetation along existing and planned cycle ways from Linksley Avenue in Castle Hill through to Rosebery Road in Kellyville. The Study Area has been divided into Sections based on the presence of existing tracks and trails (see *Figure 3.2*).

Native vegetation is present along the length of the proposed cycleway is generally in good condition. Cattai Creek flows north from Fred Caterson Reserve below the end of Rosebery Road. An unnamed eastern tributary of Cattai Creek flows behind from Linksley Avenue, below Citadel Crescent and joins Cattai Creek to the north of Chainmail Crescent.

In order to assess the likelihood of native fauna species utilising the vegetation within the Study Area a fauna survey was undertaken. Any species listed as threatened under the NSW *TSC Act* and/or the Commonwealth *EPBC Act* 1999 (see *Table 4.2*) were targeted during the survey.

4.2 Fauna Methods

The diurnal fauna survey and habitat assessment was undertaken by Ecologist Rebecca Carman (BSc, MPhil, PGDipWldMgt) on 4th and 14th September 2012. Six (6) hours were spent surveying the resources of the Study Area.

The fauna field survey was aimed at assessing the species richness of the site; to investigate the range of fauna habitats present, and to determine the potential for local threatened fauna species to occur.

The fauna survey incorporated a range of techniques designed to target species from all fauna groups that would be expected to occur on the site, including birds, mammals and reptiles. These techniques included a series of diurnal bird censuses, searches for active herpetofauna (reptiles), and recording of indirect evidence of fauna presence (e.g. tracks, scats, hollows, nests, diggings, bones and other traces). In addition, all opportunistic sightings of fauna were recorded.

All relevant previous reports and databases were reviewed and drawn upon. Particular attention was paid to records of species listed under the Schedules of the *EPBC* or *TSC Acts.*

Field surveys were restricted to the land that comprised the Study Area, although observation of birds utilising the nearby open grasslands was also made. While surveying this area, the condition and structure of any fauna habitats present were identified, and a consideration of their potential to support locally-occurring populations of threatened fauna was determined.

Species specific survey methods are set out below.

Diurnal Birds

Formal bird point censuses were conducted in three (3) locations throughout the Study Area. The formal census involved 'point bird counts' at these locations. This method was used in addition to the opportunistic bird census conducted over the remaining areas of the Study Area. Birds were identified on the basis of visual identification and by their characteristic calls. All opportunistic observations of bird species were recorded while undertaking general field survey activities.

Herpetofauna Census

Reptiles and amphibians were surveyed using hand-searches around the Study Area. Searches concentrated on areas containing woody debris or urban refuse, those on and around rock terraces and around the base of trees; and this included techniques such as carefully turning over rocks, logs or garden furniture wherever these were encountered. These were replaced on site after inspection. All opportunistic sightings were noted.

Bats

Two (2) stationary ultrasonic bat call detectors (AnaBat SD1, Titley Electronics) were used to record bat calls throughout the Study Area. The units were positioned where predicted 'fly-ways' exist and left in position overnight for one (1) night.

In relation to the analysis of those microchiropteran calls obtained, it is noted that some insectivorous bat species have distinctive echolocation calls that are unlikely to be confused with those of other species. Other bats species overlap in both call frequency and structure, making identification problematic in some cases. The degree of confidence or reliability associated with call identifications will depend on the quality of the recordings as well as the activity of the bat at the time of recording and flight direction. In some instances, a particular species may be identified with confidence, while at other times its identification will be less certain.

Searches for Evidence of Species Presence

Searches were conducted for animal scats of both predatory and non-predatory species. Where these were encountered, scats were identified on site; first to genus and then to species level, wherever possible. The search concentrated on the ground area beneath trees, in garden beds and edge sites, as well as amongst leaf litter and on the open lawns.

Searches were also made for other characteristic signs of fauna species' presence; including tracks, bones, hair, shed skins and animal remains, as well as nests, diggings, burrows, chew marks, scratchings and pellets (indicative of birds of prey).

4.2.1 Limitations to Fauna Field Surveys

The diversity of the species recorded during the current field surveys is expected to be influenced by seasonal factors, with some species likely to be inconspicuous, or absent from the above-ground populations during particular times of the year. For these reasons, survey results can always be improved by extending the time allowed to provide an investigation in all seasons.

The list of fauna species recorded by the current field surveys should not be regarded as being fully comprehensive, but rather as providing an indication of the species present at the time of the survey (September 2012). Surveys carried across all seasons over a period of several years are needed to identify all of the species present in an area, especially as some species are only present at certain times of the year (e.g. migratory birds), while others may require specific weather patterns and seasonal conditions for optimum levels of detection, e.g. amphibians.

Therefore, when establishing the suite of resident native species occurring or potentially occurring in an area by utilising the habitat requirements and associations of these animals, the diversity of other native species that could occur on occasion can be determined. For example, if a hollow-associated owl is detected, then there is the potential that, if previously recorded in the vicinity of the Study Area, other species of owls with similar nesting requirements may also be present. By using those species recorded to predict the full range of fauna potentially present in the Study Area helps to overcome some of the limitations associated with seasonal constraints and of surveys of limited duration.

4.3 Survey Results

Fauna Species Recorded

Previous fauna surveys and compilation lists from OEH and SEWPAC databases have identified 51 mammals, 215 birds, 29 native reptiles, and 20 native frogs for the Region (i.e. within a 10 x 10 km area centred on the Study Area). Of those native species previously recorded in the Region, 80 are listed as 'vulnerable', 'endangered' and/or 'migratory' under the Schedules to the *EPBC* and/or *TSC Acts* (see *Table 3.2*). The endangered Cumberland Plain Land Snail is also known to occur within the Region.

By the completion of the current field survey (September 2012), 31 bird species were detected within, adjacent to, or flying over the Study Area; the latter identified by their distinctive calls as well as observation (*Table 4.1*). Two (2) of these birds are listed as 'threatened' under the *TCS Act*.

One (1) species of native frog was heard calling along the unnamed tributary of Cattai Creek, and two (2) species of native reptile were observed along the existing tracks (*Table 4.1*).

A number of microbats, including one (1) threatened species, were detected along existing tracks through the Study Area (*Table 4.1*).

Dogs and cats are kept as pets by residents on properties neighbouring the cycleway. The track is also regularly used by people walking dogs.

Table 4.1: Fauna Species recorded during Opportunistic & Diurnal Surveys

Observation Type:

A	Stranding/Beaching	I	Subfossil/Fossil remains	S	Shot
B	Burnt	K	Dead	T	Trapped or netted
C	Cat kill	M	Miscellaneous	U	Anabat
D	Dog Kill	N	Not located	V	Fox kill
E	Nest/Roost	O	Seen	W	Heard
F	Tracks or scratchings	P	Scat	X	In scat
FB	Burrow	Q	Camera	Y	Bone, teeth, shell
G	Crushed cones	R	Road kill	Z	In raptor/owl pellet
H	Hair, feathers or skin				

* Introduced species > greater than + at least

COMMON NAME	SCIENTIFIC NAME	OBSERVATION METHOD	COUNT	
			WITHIN SITE	NEARBY/FLY-OVER
Amphibians (1)				
Common Eastern Froglet	*Crinia signifera*	W	1+	-
Birds (31)				
Australian King-Parrot	*Alisterus scapularis*	O	2	-
Australian Magpie	*Gymnorhina tibicen*	O	1	-
Australian Raven	*Corvus coronoides*	O	1	-
Brown Cuckoo-Dove	*Macropygia amboinensis*	O	2	-
Brown Gerygone	*Gerygone richmondi*	O	1	-
Brown Thornbill	*Acanthiza pusilla*	O	1	-
Buff-banded Rail	*Gallirallus philippensis*	O	1	-
Common Bronzewing	*Phaps chalcoptera*	O/W	1	1
Common Myna*	*Acridotheres tristis*	O	-	2
Crested Pigeon	*Ocyphaps lophotes*	O	2	-
Crimson Rosella	*Platycercus elegans*	O	4	-
Eastern Koel	*Eudynamys orientalis*	W	-	1
Eastern Whipbird	*Psophodes olivaceus*	O/W	1	-
Eastern Yellow Robin	*Eopsaltria australis*	O	1	-
Galah	*Eolophus roseicapillus*	O	4	-
Golden Whistler	*Pachycephala youngi*	O	1	-
Grey Fantail	*Rhipidura fuliginosa*	O	1	-
Laughing Kookaburra	*Dacelo novaeguineae*	O	-	1
Lewin's Honeyeater	*Meliphaga lewinii*	O	1	-
Little Lorikeet	*Glossopsitta pusilla*	O	2	-
Musk Lorikeet	*Glossopsitta concinna*	O	2	-
Noisy Miner	*Manorina melanocephala*	O	2	-
Pied Currawong	*Strepera graculina*	W	-	1
Powerful Owl	*Ninox strenua*	W	-	1
Rainbow Lorikeet	*Trichoglossus haematodus*	O	5+	-
Red Wattlebird	*Anthochaera carunculata*	W	1	-
Red-browed Finch	*Neochmia temporalis*	O	4	-

Rufous Whistler	*Pachycephala rufiventris*	O	1	-
Sulphur-crested Cockatoo	*Cacatua galerita*	O	-	2
White-cheeked Honeyeater	*Phylidonyris nigra*	O	1	-
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	O	1	-
Reptiles (2)				
Delicate Garden Skink	*Lampropholis delicata*	O	4	-
Eastern Water Skink	*Eulamprus quoyii*	O	1	-
Mammals (5)				
Cat*	*Felis catus*	O	1	1
Chocolate Wattled Bat	*Chalinolobus morio*	U (confident)	1+	N/A
Dog*	*Canis lupus familiaris*	O/W	-	2
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	U (probable)	1+	N/A
Eastern Freetail-bat	*Mormopterus ridei*	U (confident)	1+	N/A
Little Forest Bat	*Vespadelus vulturnus*	U (confident)	1+	N/A

Note: These records include species recorded in a previous study conducted by the author in May 2011

4.3.1 Fauna Habitat Assessment

Habitat Type: *Woodland* Fauna Conservation Significance: *High*

From Linksley Avenue through to Rosebery road, the tracks pass through Woodland habitat in good condition. There are plentiful hollow-bearing (habitat) trees of varying sizes for nesting, sheltering and roosting. Habitat trees within three (3) metres of existing track in Sections 1 and 2 or near proposed route of new cycleway in Section 3 are shown in *Figure 3.2*. The vegetation between the existing tracks and residential properties is usually in a more degraded condition due to invasion of weeds and garden escapes from backyards and (in some locations) the disposal of garden debris on the slopes adjacent to the track. Retaining walls and remaining sandstone outcrops do however provide additional habitat features for fauna, particularly reptiles.

Habitat Type: *Riparian/creek* Fauna Conservation Significance: *Moderate*

Cattai Creek flows from Fred Caterson Reserve where it meets an unnamed tributary to the north of Chainmail Crescent. Both creeks have some deep pools and exposed bedrock. Water quality is generally poor. The vegetation along the banks of Cattai Creek is degraded by woody weed species such as Privet and by the scrambling ground cover Wandering Jew. Water bodies may provide foraging sites for birds and bats. Dense vegetation along the creeks (including weed thickets) provides nesting and shelter sites for birds, reptiles and small mammals.

4.3.2 Wildlife Corridors

The vegetation along Cattai Creek and its tributaries is part of a network of riparian wildlife corridors through the Hills Shire. These corridors are important for the movement and dispersal of fauna species. Efforts should be made to maintain and enhance these limited connections. In the suburbs of Castle Hill, Glenhaven and Kellyville these corridors are usually surrounded by roads and/or residential properties.

4.3.3 Threatened Fauna Assessment

Table 4.2 assesses the likelihood of threatened fauna species previously recorded, and/or thought to potentially occur within the Study Region, being present, or utilizing the Study Area. It also considers any potential impacts the Proposal may have on the said threatened species.

The **Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)** was detected within the Study Area during the field surveys (September 2012). The **Little Lorikeet (*Glossopsitta pusilla*)** was observed in the canopy trees along the existing fire trail.

The vegetation along the cycleway from Linksley Avenue to Rosebery road contains sufficient resources to support other threatened fauna species, some of which are likely to utilise resources of the riparian corridor from time to time (see *Table 4.2*).

Cycleway construction along each of the three (3) sections will vary in width and construction mode, but it is expected that only construction on the 3rd section (from Chainmail Crescent to Rosebery Road) is likely to have a significant impact on the surrounding vegetation and thus on fauna habitats.

Under the precautionary principle, a Seven-part Test of Significance for each of the following species has been undertaken:

- Little Lorikeet (*Glossopsitta pusilla*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Powerful Owl (*Ninox strenua*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)

These Assessments of Significance considered the impacts of the construction of the Cycleway Link from Linksley Avenue to Rosebery Road and a provided in *Appendix 6.*

Table 4.2: Threatened Fauna Assessment

E1 = Endangered Species and V = Vulnerable Species

* Habitat requirements were generally extracted from Churchill (2009) and OEH (2012), with other references used being identified in the bibliography.

^ Within a 10 x 10 km^2 area centred on the Study Area

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS	CLOSEST PROXIMITY & DATE	MOST RECENT & PROXIMITY		
Amphibians (1)								
Red-crowned Toadlet (*Pseudophryne australis*)	V	-	Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Prefers sandstone areas, breeding in dense vegetation and debris beside ephemeral creeks and gutters. Individuals can be found under logs, rocks and leaf-litter in non breeding periods.	14	1.07km (1999)	2008 (2.68km)	Moderate	Some suitable habitat present, although water quality is unlikely to be suitable. Creek will not be modified during the construction process. **Further assessment of this species is not required.**
Birds (5)								
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	V	-	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Favours old growth attributes for nesting and roosting.	4	2.55km (1981)	2007 (4.21km)	Moderate	Unlikely to occur in the Study Area. No suitable nesting or roosting habitat along proposed cycleway. **Further assessment of this species is not required.**

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS	CLOSEST PROXIMITY & DATE	MOST RECENT & PROXIMITY		
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	V	-	Prefers open forests with *Allocasuarina* species as the main food source. Uses hollows for nesting.	7	1.36km (2000)	2003 (8.88km)	Low	No suitable feed trees or nesting sites present. **Further assessment of this species is not required.**
Little Lorikeet (*Glossopsitta pusilla*)	V	-	Foraging habitat includes eucalyptus tree canopies with nectar and pollen available. Requires hollow bearing trees for breeding.	2	1.20km (1997)	1997 (1.20km)	High	Detected during current field surveys. Possible nesting site identified in *Section 3*. Suitable habitat available throughout study area. **FURTHER ASSESSMENT OF THIS SPECIES IS REQUIRED.**
Powerful Owl (*Ninox strenua*)	V	-	Forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting.	27	0.89km (2010)	2010 (0.89km)	High	Potential roosting habitat available in nearby gullies. Multiple records of the species occurring within 2km of the Study Area. **FURTHER ASSESSMENT OF THIS SPECIES IS REQUIRED.**
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Builds nests in forks of trees.	5	0.58km (1992)	2005 (3.73km)	Moderate	Suitable foraging habitat present. May utilise resources within the Study Area. **FURTHER ASSESSMENT OF THIS SPECIES IS REQUIRED.**

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS	CLOSEST PROXIMITY & DATE	MOST RECENT & PROXIMITY		
Mammals (6)								
Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)	V	-	Prefers areas where there are caves, old mines, old buildings, storm water drains & well timbered areas. This species may travel large distances from roosting site for foraging.	28	1.51km (2008)	2008 (6.14km)	High	Detected during current field surveys. Suitable habitat present along the proposed cycleway. Likely to utilise nearby resources. **FURTHER ASSESSMENT OF THIS SPECIES IS REQUIRED.**
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V	-	Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter.	4	0.81km (2010)	2010 (0.81km)	High	Suitable habitat present along the proposed cycleway. Likely to utilise the nearby resources. **FURTHER ASSESSMENT OF THIS SPECIES IS REQUIRED.**
Eastern Freetail-bat (*Mormopterus norfolkensis*)	V	-	Prefers dry and swamp forests, woodlands. Roost in tree hollows, under bark or man-made structures. Insectivorous.	10	1.08km (1999)	2008 (1.51km)	Moderate	Suitable habitat present along the proposed cycleway. Likely to utilise the nearby resources. **FURTHER ASSESSMENT OF THIS SPECIES IS REQUIRED.**
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Occur in sub-tropical and temperate forests and urban areas. Roost in trees near food sources (nectar/pollen/fruits). Large numbers in roosts used for breeding and young rearing. Site fidelity is high.	15	0.81km (2010)	2010 (0.81km)	Moderate	Some suitable foraging habitat present when Eucalypts are in flower. **FURTHER ASSESSMENT OF THIS SPECIES IS REQUIRED.**

COMMON NAME & SCIENTIFIC NAME	LEGAL STATUS		HABITAT REQUIREMENTS*	DISTRIBUTION IN THE REGION^			POTENTIAL UTILISATION OF STUDY AREA	LIKELY IMPACT & ASSESSMENT CONSIDERATIONS
	TSC ACT	EPBC ACT		NUMBER OF RECORDS	CLOSEST PROXIMITY & DATE	MOST RECENT & PROXIMITY		
Southern Myotis (*Myotis macropus*)	V	-	Roosts in groups of 10-15 close to water in caves, shafts, tree hollows, storm water channels, buildings, under bridges and in dense foliage. Forage over water for insects and small fish.	1	2.72km (2004)	2004 (2.72km)	Low	Some suitable habitat present. Only one (1) record of the species occurring in the Region. Unlikely to utilise the resources of the Study Area. **Further assessment of this species is not required.**
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	V	-	Roosts in groups of up to 6 in tree hollows, mammal burrows or buildings. Forage high over canopy for insects.	1	3.73km (2005)	2005 (3.73km)	Low	Some suitable habitat present. Only one (1) record of the species occurring in the Region. Unlikely to utilise the resources of the Study Area. **Further assessment of this species is not required.**
Gastropods (1)								
Cumberland Plain Land Snail (*Meridolum corneovirens*)	E1	-	Inhabits Cumberland Plain Woodland under litter, bark, leaves and logs. May shelter in loose soil around grass clumps. Fungus specialist.	5	0.81km (2010)	2010 (0.81km)	Low	No suitable habitat present along the edge of the proposed cycleway. Unlikely to be present. **Further assessment of this species is not required.**

5 CONCLUSION, DECLARATION & SIGN-OFF

This Ecological Investigation has provided baseline data for the Cattai Creek Riparian Corridor. it also provides an assessment of the potential impacts that may arise from the construction of a Cycleway Link in the Corridor between Linksley Avenue and Rosebery Road. Further assessment of ecological impacts has been provided in the Review of Environmental Factors (UBM, in progress).

Impacts upon the Ecological Community may be described as Direct Impacts – activities expected to directly affect the listed community e.g. clearing if vegetation, or Indirect Impacts – activities which are expected to affect the listed community indirectly e.g. changes in local hydrology and an increase in soil nutrient levels due to runoff from lawns and gardens.

Plant Communities: Three (3) plant communities are mapped for the Study Area: Hinterland Sandstone Gully Forest, Riparian Scrub, and a small area of Sydney Turpentine Ironbark Forest ('STIF') at the south-eastern end of the proposed Cycleway route (see *Figure 2.2*).

Of these communities, only STIF is listed as an EEC under *TSC Act;* therefore a Seven-part Test has been applied to assess the impacts of the Cycleway Proposal on this community. Given the proposed location of the Cycleway Link over an existing bush track, no further clearing is envisaged and therefore no significant impact was recorded. STIF is also listed as a Critically Endangered Ecological Community ("CEEC') under *EPBC Act*, although the small size of the remnant occurring in the Study Area (< one hectare) does not warrant an Assessment of Significance under the *EPBC Act* Guidelines (see *Appendix 5c*).

Flora: Two (2) flora species listed as 'Vulnerable' under the *TSC Act* were recorded: *Epacris purpurascens* var*. purpurascens* and *Darwinia biflora.* One (1) specimen of Brush Cherry (*Syzygium paniculatum*) was also recorded (*TSC Act* and *EPBC Act*), but this is believed to be a horticultural planting or a garden escape (see *Figure 3.1*). Seven-part tests carried out for the two (2) species listed under the TSC Act recorded no significant impact (see *Appendix 5*).

Fauna: Two (2) species listed under the *TSC Act* were recorded: the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Little Lorikeet (*Glossopsitta pusilla*). Both species are listed as 'Vulnerable' under the *Act*. Given that suitable habitat is present, it is possible that other threatened species recorded for the Region would utilise the resources of the Study Area or the neighbouring properties on occasion for foraging, hunting, nesting or roosting.

Under the precautionary principle, a Seven-part Test of Significance (see *Appendix 6*) for each of the following species has considered the impacts of the construction of the Cycleway Link from Linksley Avenue to Rosebery Road:

- Little Lorikeet (*Glossopsitta pusilla*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Powerful Owl (*Ninox strenua*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Eastern Freetail-bat (*Mormopterus norfolkensis*)

- Grey-headed Flying-fox (*Pteropus poliocephalus*)

Each of the Seven-part Tests carried out for the species listed above have concluded that provided that the recommendations set out in this Report are followed, there will be no significant impact on any threatened fauna species. Therefore it will not be necessary to apply to the Director General Environment and Heritage for the preparation of a Species Impact Statement for fauna issues.

Cycleway construction methods along each of the three (3) sections of the proposed Cycleway Link route will vary, although it is expected that only construction on the 3rd section (from Chainmail Crescent to Rosebery Road) that is likely to have an impact on the surrounding vegetation.

Recommendations:

In considering the potential ecological impacts of the construction of the Cycleway Link from Linksley Avenue to Rosebery Road, UBM recommends that:

- Wherever possible, clearing of native vegetation (bushland) to facilitate the construction of the Cycleway Link should be confined to the smallest area required for development given safety considerations and best practice cycleway design (i.e. 2.5 to 3 metres maximum)
- Bushland on either side of the bush track and fire trail should be subject to bush regeneration works or at the very least, to targeted weed control.
- Targeted weed control should be undertaken *prior to* commencement of works, with emphasis on the removal of noxious weeds. As the unnamed eastern tributary creek forms a small catchment starting at Linksley Avenue, a unique opportunity exists to control target weeds from the head of catchment down to its intersection with Cattai Creek.
- Fauna habitat should be maintained. Habitat (hollow-bearing) trees should be located (as per *Figure 3.2*) and protected during construction.
- Weed debris and other rubbish generated by construction is to be removed off-site to a landfill depot, and not left stockpiled along track edges.
- Future landscaping along the route should use only locally indigenous species. No areas of bare or disturbed soil are to be left following construction.

By adopting the recommendations identified in this Report, the impacts of the Cycleway Link Proposal on the native bushland, flora or fauna species or populations occurring within the Study Area will be minimised.

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7 APPENDICES

APPENDIX 1: Description Hinterland Sandstone Gully Forest after Tozer 2006.

DSF p142: Hinterland Sandstone Gully Forest
Sample Sites: 142
Area Extant (ha): 90900
Estimated % remaining: 80-95%
Area in conservation reserves (ha): 46800
Estimated % of pre-clearing area: 35-55%
No. taxa (total / unique): 524 / 3
No. taxa per plot (±sd): 45.2(11.6)

Hinterland Sandstone Gully Forest (DSF p142) is equivalent to DSF 142 identified by Tindall *et al.* (2004), and is an open eucalypt forest with an abundant sclerophyll shrub stratum and a groundcover dominated by sedges. This forest surrounds the Cumberland plain, occurring along the western portion of the Hornsby and Woronora plateaux and in the lower Blue Mountains. Within this distribution Hinterland Sandstone Gully Forest occurs on lower slopes of dry sandstone gullies up to 600m ASL where average annual rainfall ranges from 850 to 1300mm. Hinterland Sandstone Gully Forest grades into Sandstone Riparian Scrub (FOW p58) immediately adjacent to creeklines and is replaced by Coastal Sandstone Ridgetop Woodland (DSF p131) or Wingecarribee-Burragorang Sandstone Forest (DSF p144) on upper slopes and exposed positions. As rainfall increases toward the coast, it is replaced by Coastal Sandstone Gully Forest (DSF p140).

Hinterland Sandstone Gully Forest comprises part of the Sydney Hinterland Dry Sclerophyll Forests vegetation class (Keith 2004). About one third of its original extent has been supplanted by urban development. Large areas remain, including examples in conservation reserves, though edge effects such as weed invasion and high fire frequency are evident in some locations.

Floristic Summary:

Trees: *Angophora costata, Corymbia gummifera, Banksia serrata, Eucalyptus piperita.* **Shrubs:** *Persoonia linearis, P. levis, Phyllanthus hirtellus, Leptospermum trinervium, Lomatia silaifolia, Banksia spinulosa, Platysace linearifolia, Ceratopetalum gummiferum, Acacia ulicifolia, Acacia terminalis.* **Climbers:** *Billardiera scandens.* **Groundcover:** *Entolasia stricta, Pteridium esculentum, Dianella caerulea, Smilax glyciphylla, Xanthosia pilosa, Lomandra longifolia, Lepidosperma laterale, Lomandra obliqua.*

Vegetation structure:

Stratum	Frequency (n=100)	Height (m) (+StDev)	Cover (%) (+StDev)
Emergent	2	20 (2.8)	5 (-)
Tree canopy	99	22.1 (5.2)	26.5 (12.8)
Small tree	80	9.1 (3.8)	26 (18.2)
Shrub	54	2.4 (0.6)	27 (21.4)
Ground cover	100	1 (0.3)	23.7 (23.8)

Diagnostic Species:
A 0.04ha plot located in this Map Unit is expected to contain at least 25 positive diagnostic species (95% confidence interval) provided that the total number of native species in the plot is 37 or greater. A 95% confidence interval means that five percent of plots sampled (1 in 20 plots) in this Map Unit may contain fewer than 25 positive diagnostic species.

C/A: Cover/abundance within Map Unit (50 percentile)

Freq: Frequency (%) within Map Unit

C/AO: Cover/abundance in other Map Units (50 percentile)

FreqO: Frequency (%) within other Map Units

SPECIES	C/A	Freq	C/AO	FreqO
Acacia hispidula	1	2	1	0
Acacia linifolia	1	46	1	5
Acacia longifolia	1	18	1	9
Acacia parvipinnula	1	3	1	1
Acacia suaveolens	1	27	1	7
Acacia terminalis	1	49	1	11
Acacia ulicifolia	1	52	1	9
Acianthus fornicatus	1	15	1	1
Acianthus pusillus	1	2	1	0
Acrotriche divaricata	1	7	1	1
Actinotus helianthi	1	20	1	1
Allocasuarina littoralis	1	39	1	16
Allocasuarina torulosa	2	30	1	4
Amperea xiphoclada	1	17	1	7
Angophora bakeri	1	7	1	2
Angophora costata	2	72	1	6
Anisopogon avenaceus	1	12	1	5
Asterolasia correifolia	1	3	2	0
Astrotricha floccosa	1	11	1	0
Astrotricha latifolia	1	11	1	2
Astrotricha longifolia	1	4	1	0
Austrostipa pubescens	1	24	1	5
Banksia serrata	1	51	1	9
Banksia spinulosa var. spinulosa	1	62	1	14
Billardiera scandens	1	56	1	27
Boronia ledifolia	1	21	1	3
Bossiaea heterophylla	1	20	1	5
Bossiaea lenticularis	1	5	1	0
Bossiaea neo-anglica	1	3	1	0
Bossiaea obcordata	1	22	1	7
Bossiaea rhombifolia subsp. rhombifolia	2	10	1	1
Calochlaena dubia	2	20	1	9
Cassytha glabella	1	16	1	8
Cassytha pubescens	1	23	1	8
Caustis flexuosa	1	30	1	7
Ceratopetalum gummiferum	1	54	1	3
Cheilanthes distans	1	7	1	2
Chloanthes stoechadis	1	3	1	0
Correa reflexa	1	13	1	5
Corymbia eximia	2	13	1	2
Corymbia gummifera	1	72	2	15

SPECIES	C/A	Freq	C/AO	FreqO
Crowea exalata subsp. exalata	2	2	1	0
Crowea saligna	1	2	1	0
Dampiera purpurea	1	20	1	4
Dendrobium linguiforme	1	5	1	0
Dianella caerulea	1	75	1	27
Dillwynia retorta	1	44	1	6
Dodonaea pinnata	1	2	1	0
Dodonaea triquetra	1	39	1	5
Dracophyllum secundum	1	3	1	0
Elaeocarpus reticulatus	1	41	1	11
Entolasia stricta	1	83	1	33
Epacris pulchella	1	20	1	5
Eriostemon australasius	1	20	1	3
Eucalyptus agglomerata	3	25	2	7
Eucalyptus notabilis	1	3	1	1
Eucalyptus pilularis	3	26	2	4
Eucalyptus piperita	3	47	2	8
Eucalyptus punctata	2	33	2	8
Eucalyptus resinifera subsp. resinifera	1	3	1	1
Eucalyptus umbra	2	3	1	0
Gompholobium grandiflorum	1	12	1	3
Gompholobium latifolium	1	21	1	3
Gonocarpus teucrioides	1	38	1	17
Goodenia decurrens	2	6	1	0
Goodenia heterophylla	1	6	1	2
Grevillea buxifolia subsp. buxifolia	1	9	1	3
Grevillea mucronulata	1	42	1	3
Grevillea phylicoides	1	3	1	1
Grevillea sericea	1	10	1	2
Haemodorum planifolium	1	5	1	1
Hakea dactyloides	1	34	1	11
Hakea sericea	1	20	1	6
Hibbertia bracteata	1	10	1	1
Hibbertia monogyna	1	4	1	1
Hibbertia saligna	2	2	1	0
Hovea linearis	1	21	1	9
Hovea purpurea	1	5	1	0
Lambertia formosa	1	36	1	8
Lasiopetalum ferrugineum	1	9	1	2

SPECIES	C/A	Freq	C/AO	FreqO
Lasiopetalum parviflorum	1	3	1	0
Leionema dentatum	1	3	1	0
Lepidosperma filiforme	1	8	1	2
Lepidosperma laterale	1	59	1	28
Leptomeria acida	1	16	1	4
Leptospermum polygalifolium	1	18	1	8
Leptospermum trinervium	1	68	1	15
Leucopogon ericoides	1	9	1	2
Leucopogon exolasius	1	3	1	0
Leucopogon muticus	1	6	1	1
Leucopogon setiger	1	5	1	1
Lindsaea microphylla	1	36	1	5
Liparis reflexa	1	3	1	0
Lissanthe sapida	1	5	1	1
Logania albiflora	1	13	1	1
Lomandra brevis	1	3	1	0
Lomandra confertifolia subsp. rubiginosa	1	16	1	4
Lomandra cylindrica	1	28	1	4
Lomandra filiformis subsp. filiformis	1	27	1	10
Lomandra gracilis	1	36	1	3
Lomandra longifolia	1	63	1	43
Lomandra multiflora subsp. multiflora	1	39	1	24
Lomandra obliqua	1	49	1	13
Lomatia silaifolia	1	62	1	9
Marsdenia suaveolens	1	14	1	2
Monotoca scoparia	1	26	1	12
Olearia tomentosa	1	3	1	1
Opercularia aspera	1	17	1	8
Patersonia glabrata	1	28	1	9
Patersonia sericea	1	28	1	8
Persoonia levis	1	67	1	12
Persoonia linearis	1	74	1	28
Persoonia mollis subsp. mollis	2	5	1	1
Persoonia myrtilloides	1	2	1	0
Persoonia pinifolia	1	14	1	3
Petrophile pulchella	1	13	1	6
Philotheca hispidula	1	9	1	1
Philotheca scabra	1	6	1	0
Phyllanthus hirtellus	1	66	1	13
Platysace linearifolia	1	61	1	7
Poa affinis	1	9	1	1
Polyscias sambucifolia	1	13	1	6
Pomaderris discolor	1	5	1	0
Pomaderris intermedia	1	3	1	0
Pomaderris lanigera	1	7	1	1
Pomax umbellata	1	32	1	13
Prostanthera linearis	1	2	1	0
Pterostylis acuminata	1	3	1	0
Pteridium esculentum	1	84	1	36
Pterostylis longifolia	1	5	1	1
Pultenaea daphnoides	1	14	1	4
Pultenaea ferruginea	1	7	1	1
Pultenaea flexilis	1	31	1	1
Pultenaea scabra	2	9	1	1
Ricinocarpos pinifolius	1	13	1	1
Schizaea bifida	1	5	1	1
Schoenus imberbis	1	5	1	1
Schoenus melanostachys	1	11	1	2
Smilax glyciphylla	1	67	1	7
Stylidium laricifolium	1	11	1	1
Stylidium productum	1	23	1	1
Styphelia viridis subsp. viridis	1	3	1	0
Syncarpia glomulifera subsp. glomulifera	1	35	2	7
Telopea speciosissima	1	13	1	2
Tristaniopsis collina	1	7	1	2
Woollsia pungens	1	9	1	2
Xanthorrhoea arborea	2	34	1	1
Xanthorrhoea media	1	16	1	4
Xanthosia pilosa	1	63	1	7
Xanthosia tridentata	1	20	1	5
Xylomelum pyriforme	1	35	1	3
Zieria laevigata	1	3	1	0
Zieria pilosa	1	8	1	1

APPENDIX 2: Description Sandstone Riparian Scrub after Tozer 2006.

FOW p58: Sandstone Riparian Scrub
Sample Sites: 22
Area Extant (ha): 2900
Estimated % remaining: >90%
Area in conservation reserves (ha): 1300
Estimated % of pre-clearing area: 30-50%
No. taxa (total / unique): 263 / 0
No. taxa per plot (±sd): 34(11.4)

Sandstone Riparian Scrub (FOW p58) is equivalent to FOW 58 identified by Tindall *et al.* (2004). This distinctive unit is a scrub or low forest with clumped shrubs and a clumped groundcover dominated by sedges and ferns. It is distributed around the edges of the Sydney basin on streams draining Triassic Hawkesbury and Narrabeen sandstone, in the Blue Mountains, Hornsby, Woronora and Nattai Plateaux. Outlying occurrences of this unit are also mapped in Morton National Park (Holland Creek Gorge and Clyde River gorge), where Sandstone Riparian Scrub was sampled on Ordovician sediments below Permian Shoalhaven Group sandstone and conglomerate geologies. Within this distribution Sandstone Riparian Scrub is restricted to shallow sand and gravel alluvium over rock on the bed and banks of streams subjected to occasional high-velocity floods. Elevation of sampled sites varies between 10m and 450m ASL, while mean annual rainfall is 800-1500mm.

This unit falls within the Eastern Riverine Forests vegetation class (Keith 2004). Several examples are represented within conservation reserves, though these are susceptible to polluted runoff and weed invasion from urban areas in the stream catchments.

Representation of this unit on the vegetation map was dependent upon API delineation of narrow strips of riparian scrub, which may have been undetected in some situations (eg. in deep gorges). As a result, the extent of FOW p58 is likely to be underestimated, and some of the sampled locations of this unit will be mapped as surrounding vegetation types (eg. DSF p140, DSF p142, WSF p102).

Floristic Summary:

Trees: *Tristaniopsis laurina, Ceratopetalum apetalum.* **Shrubs:** *Lomatia myricoides, Tristania neriifolia, Leptospermum morrisonii.* **Groundcover:** *Lomandra longifolia, Entolasia stricta, Schoenus melanostachys, Lomandra fluviatilis, Sticherus flabellatus.*

Vegetation structure:

Stratum	Frequency (n=6)	Height (m) (+StDev)	Cover (%) (+StDev)
Emergent	17	13 (-)	4 (-)
Tree canopy	83	11.8 (8)	24.2 (26.6)
Small tree	33	9 (1.4)	20 (14.1)
Shrub	83	2.5 (1)	8.6 (4.7)
Ground cover	100	0.6 (0.3)	7.7 (3)

Diagnostic Species:

A 0.04ha plot located in this Map Unit is expected to contain at least 8 positive diagnostic species (95% confidence interval) provided that the total number of native species in the plot is 27 or greater. A 95% confidence interval means that five percent of plots sampled (1 in 20 plots) in this Map Unit may contain fewer than 8 positive diagnostic species.

C/A: Cover/abundance within Map Unit (50 percentile)
Freq: Frequency (%) within Map Unit
C/AO: Cover/abundance in other Map Units (50 percentile)
FreqO: Frequency (%) within other Map Units

SPECIES	C/A	Freq	C/AO	FreqO
Acacia floribunda	1	27	1	2
Acacia obtusifolia	3	32	1	9
Angophora costata	1	27	1	7
Austromyrtus tenuifolia	1	23	1	0
Backhousia myrtifolia	1	27	2	5
Bauera rubioides	1	32	1	1
Callistemon citrinus	1	27	1	1
Callicoma serratifolia	2	32	1	3
Cassytha glabella	1	32	1	8
Ceratopetalum apetalum	1	68	3	3
Daviesia corymbosa	1	23	1	2
Dodonaea triquetra	1	41	1	6
Entolasia stricta	1	68	1	33
Gahnia clarkei	1	23	1	2
Gleichenia dicarpa	1	36	1	2
Grevillea oleoides	1	36	1	2
Guringalia dimorpha	2	23	1	1
Leionema dentatum	1	36	1	0

SPECIES	C/A	Freq	C/AO	FreqO
Leptospermum morrisonii	1	45	1	0
Leptospermum polygalifolium	1	45	1	8
Lomandra fluviatilis	2	50	1	0
Lomandra longifolia	1	77	1	43
Lomatia myricoides	2	86	1	4
Micrantheum hexandrum	1	23	1	0
Monotoca scoparia	1	36	1	12
Persoonia pinifolia	1	23	1	4
Pseudanthus pimeleoides	1	27	2	0
Schoenus melanostachys	1	55	1	2
Smilax glyciphylla	1	36	1	8
Stenocarpus salignus	1	32	1	2
Sticherus flabellatus var. flabellatus	3	50	1	1
Todea barbara	1	23	1	1
Tristaniopsis laurina	3	86	1	1
Tristania neriifolia	1	55	1	0

APPENDIX 3: Sydney Turpentine-Ironbark Forest - endangered ecological community listing NSW Scientific Committee - final determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list the Sydney Turpentine-Ironbark Forest as an ENDANGERED ECOLOGICAL COMMUNITY on Part 3 of Schedule 1 of the Act. The listing of endangered ecological communities is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. The Sydney Turpentine-Ironbark Forest (STIF) is the name given to the plant community that is characterised by the following assemblage of species:

- *Acacia decurrens*
- *Acacia falcata*
- *Acacia implexa*
- *Acacia longifolia*
- *Acacia myrtifolia*
- *Acacia parramattensis*
- *Allocasuarina torulosa*
- *Angophora costata*
- *Angophora floribunda*
- *Aristida vagans*
- *Billardiera scandens*
- *Breynia oblongifolia*
- *Bursaria spinosa*
- *Centella asiatica*
- *Cheilanthes sieberi*
- *Clematis aristata*
- *Clematis glycinoides*
- *Clerodendrum tomentosum*
- *Commelina cyanea*
- *Corymbia gummifera*
- *Daviesia ulicifolia*
- *Dianella caerulea*
- *Dichelachne rara*
- *Dichondra repens*
- *Dodonaea triquetra*
- *Echinopogon caespitosus*
- *Elaeocarpus reticulatus*
- *Entolasia marginata*
- *Entolasia stricta*
- *Eucalyptus acmenoides*
- *Eucalyptus globoidea*
- *Eucalyptus paniculata*
- *Eucalyptus resinifera*
- *Exocarpos cupressiformis*
- *Glycine clandestina*
- *Goodenia hederacea*
- *Goodenia heterophylla*
- *Hardenbergia violacea*
- *Imperata cylindrica*
- *Indigofera australis*
- *Kennedia rubicunda*
- *Kunzea ambigua*
- *Lepidosperma laterale*
- *Leucopogon juniperinus*
- *Lomandra longifolia*
- *Melaleuca decora*
- *Microlaena stipoides*
- *Notelaea longifolia*
- *Oplismenus aemulus*
- *Oxalis exilis*
- *Ozothamnus diosmifolius*
- *Pandorea pandorana*
- *Panicum simile*
- *Pittosporum revolutum*
- *Pittosporum undulatum*
- *Poa affinis*
- *Polyscias sambucifolia*
- *Pomax umbellata*
- *Poranthera microphylla*
- *Pratia purpurascens*
- *Pseuderanthemum variabile*
- *Rapanea variabilis*
- *Rubus parvifolius*
- *Smilax glyciphylla*
- *Stipa pubescens*
- *Syncarpia glomulifera*
- *Themeda australis*
- *Tylophora barbata*
- *Veronica plebeia*
- *Zieria smithii*

2. The total species list of the community is considerably larger than that given in 1 (above), with many species present in only one or two sites or in very small quantity. In any particular site not all of the assemblage listed in 1 may be present. At any one time, seeds of some species may only be present in the soil seed bank with no above-ground individuals present. The species composition of the site will be influenced by the size of the site and by its recent disturbance history. The number of species and the above-ground composition of species will change with time since fire, and may also change in response to changes in fire frequency.

3. The structure of the community was originally forest, but may now exist as woodland or as remnant trees.

4. Characteristic tree species in the STIF are Syncarpia glomulifera, Eucalyptus globoidea, Eucalyptus resinifera, Eucalyptus paniculata, Angophora costata and Angophora floribunda.

5. Species composition varies between sites depending on geographical location and local conditions (e.g. topography, rainfall, exposure).

6. STIF occurs within the local government areas Ashfield, Auburn, Canterbury, Concord, Drummoyne, Leichhardt, Marrickville, Bankstown, Ryde, Hunters Hill, Baulkham Hills, Ku-ring-gai, Hornsby, Parramatta, Bankstown, Rockdale, Kogarah, Hurstville, Sutherland. The area is within the County of Cumberland and entirely within the Sydney Basin Bioregion.

7. In many of these LGAs particularly in the inner western suburbs, only remnant trees may remain. These may have particular ecological and genetic significance and may be important sources of propagation material for use in rehabilitation projects.

8. STIF typically occurs on areas with clay soils derived from Wianamatta Shale, or shale layers within Hawkesbury Sandstone.

9. Occurrences of STIF may occur on plateaus and hillsides and on the margins of shale cappings over sandstone.

10. STIF is referred to in Benson & Howell 1990 and in UBBS (1997). It includes vegetation described as map unit 9o of Benson (1992) and Benson & Howell (1994).

11. STIF provides habitat for a number of plant species recognised as being of regional conservation significance in UBBS (1997). These include:

- *Acacia stricta*
- *Arthropodium milleflorum*
- *Brachychiton populneus*
- *Chloris truncata*
- *Danthonia linkii*
- *Danthonia racemosa*
- *Daviesia genistifolia*
- *Einadia nutans*
- *Einadia polygonoides*
- *Einadia trigonos*
- *Elymus scaber*
- *Glycine microphylla*
- *Lasiopetalum parviflorum*
- *Lepidosperma gunnii*
- *Leucopogon juniperinus*
- *Marsdenia viridiflora*
- *Omalanthus stillingifolius*
- *Opercularia hispida*
- *Paspalidium criniforme*
- *Platylobium formosum*
- *Pomaderris lanigera*
- *Senecio hispidulus*
- *Sporobolus creber*
- *Stipa rudis subsp. nervosa*

12. STIF has an understorey that may be either grassy and herbaceous or of a shrubby nature. STIF can have a dense understorey in areas that have not been burnt for an extended period of time.

13. Adjacent communities on sandstone soils are generally part of the Sydney Sandstone Complex (see Benson & Howell 1990).

14. It is estimated that only 0.5 % of the original area of STIF exists in the form of a number of remnants.

15. Only small areas of STIF are presently included in conservation reserves.

16. Large areas of STIF have been cleared for agriculture and urban development. Remnants are small and scattered. Identified threats include: clearing, physical damage from recreational activities, rubbish dumping, grazing, mowing, weed invasion.

17. In view of the small size of existing remnants, the threat of further clearing and other known threats, the Scientific Committee is of the opinion that Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion is likely to become extinct in nature unless the circumstances and factors threatening its survival or evolutionary development cease to operate and that listing as an endangered community is warranted.

Gazettal date: 16/10/98

References

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APPENDIX 4: List of Flora Species Recorded in Bushland for the Cattai Creek Riparian Corridor

Life Form	Species	Community 6 - Turpentine - Smooth-barked Apple Forest	Community 5 - Blackbutt Open Forest	Community 4 - Rocky Creek Riparian Scrub	Community 3 - Riverflat Scribbly - Peppermint Woodland - Open Forest	Community 2 - Sydney Peppermint Open Forest	Community 1 - Scribbly Gum Woodland	Linksley Ave Bike Track all species
Tree	*Acacia elata*					x		x
Tree	*Acmena smithii*		x					x
Tree	*Angophora bakeri*				x	x	x	x
Tree	*Angophora costata*	x	x				x	x
Tree	*Corymbia eximia*		x			x		x
Tree	*Corymbia gummifera*		x					x
Tree	*Eucalyptus crebra*					x		x
Tree	*Eucalyptus deanei*				x			x
Tree	*Eucalyptus eugenioides*						x	x
Tree	*Eucalyptus haemastoma*		x			x		x
Tree	*Eucalyptus pilularis*	x	x					x
Tree	*Eucalyptus piperita*		x		x	x		x
Tree	*Eucalyptus punctata*						x	x
Tree	*Eucalyptus racemosa*				x		x	x
Tree	*Eucalyptus resinifera subsp. resinifera*		x		x			x
Tree	*Eucalyptus saligna*				x			x
Tree	*Eucalyptus sclerophylla*				x		x	x
Tree	*Podocarpus elatus*	x						x
Tree	*Syncarpia glomulifera*	x			x			x
Small Tree	*Acacia decurrens*				x	x	x	x
Small Tree	*Acacia floribunda*		x		x			x
Small Tree	*Acacia parramattensis*						x	x
Small Tree	*Acer negundo* *	w						w
Small Tree	*Allocasuarina littoralis*		x				x	x
Small Tree	*Angophora hispida*					x	x	x
Small Tree	*Banksia ericifolia*					x	x	x
Small Tree	*Banksia serrata*		x			x		x
Small Tree	*Callicoma serratifolia*		x					x
Small Tree	*Callistemon citrinus*		x	x				x
Small Tree	*Ceratopetalum gummiferum*		x		x	x		x
Small Tree	*Cupaniopsis anacardioides*		x					x
Small Tree	*Elaeocarpus reticulatus*		x					x
Small Tree	*Melaleuca linariifolia*			x				x
Small Tree	*Homalanthus populifolius*		x					x

Life Form	Species	Community 6 - Turpentine - Smooth-barked Apple Forest	Community 5 - Blackbutt Open Forest	Community 4 - Rocky Creek Riparian Scrub	Community 3 - Riverflat Scribbly - Peppermint Woodland - Open Forest	Community 2 - Sydney Peppermint Open Forest	Community 1 - Scribbly Gum Woodland	Linksley Ave Bike Track all species
Small Tree	*Pittosporum undulatum*		x		x		x	x
Small Tree	***Syzygium paniculatum***		?					?
Small Tree	*Tristaniopsis laurina*			x				x
Shrub	*Acacia binervia*		x				x	x
Shrub	*Acacia linifolia*					x	x	x
Shrub	*Acacia longifolia subsp. longifolia*					x	x	x
Shrub	*Acacia podalyriifolia* *		w					w
Shrub	*Acacia ulicifolia*					x		x
Shrub	*Astrotricha longifolia*		x					x
Shrub	*Austromyrtus tenuifolia*			x				x
Shrub	*Baeckea brevifolia*					x	x	x
Shrub	*Banksia spinulosa*		x			x	x	x
Shrub	*Bauera rubioides*		x					x
Shrub	*Bossiaea obcordata*		x			x		x
Shrub	*Brachyloma daphnoides*						x	x
Shrub	*Breynia oblongifolia*				x			x
Shrub	*Calytrix tetragona*						x	x
Shrub	*Cestrum parqui* *				w			w
Shrub	***Darwinia biflora***						x	x
Shrub	*Dillwynia retorta*					x	x	x
Shrub	*Dillwynia rudis*						x	x
Shrub	*Dodonaea triquetra*					x	x	x
Shrub	***Epacris purpurascens var. purpurascens***		x				x	x
Shrub	*Grevillea buxifolia*		x			x	x	x
Shrub	*Grevillea mucronulata*		x			x		x
Shrub	*Grevillea speciosa*		x			x	x	x
Shrub	*Hakea dactyloides*						x	x
Shrub	***Hakea salicifolia subsp. salicifolia***				x			x
Shrub	*Hakea sericea*						x	x
Shrub	*Hibbertia monogyna*						x	x
Shrub	*Kunzea ambigua*					x	x	x
Shrub	*Lambertia formosa*		x			x	x	x
Shrub	*Lantana camara* *						w	w
Shrub	*Leptomeria acida*						x	x

Life Form	Species	Community 6 - Turpentine - Smooth-barked Apple Forest	Community 5 - Blackbutt Open Forest	Community 4 - Rocky Creek Riparian Scrub	Community 3 - Riverflat Scribbly - Peppermint Woodland - Open Forest	Community 2 - Sydney Peppermint Open Forest	Community 1 - Scribbly Gum Woodland	Linksley Ave Bike Track all species
Shrub	*Leptospermum arachnoides*						x	x
Shrub	***Leptospermum polygalifolium***					x		x
Shrub	*Leptospermum trinervium*						x	x
Shrub	*Leucopogon juniperinus*		x					x
Shrub	*Leucopogon muticus*		x			x	x	x
Shrub	*Ligustrum lucidum **				w			w
Shrub	*Ligustrum sinense **				w	w	w	w
Shrub	*Logania albiflora*						x	x
Shrub	*Lomatia silaifolia*		x			x		x
Shrub	*Micrantheum ericoides*		x					x
Shrub	*Notelaea longifolia*		x					x
Shrub	*Ozothamnus diosmifolius*					x	x	x
Shrub	*Persoonia lanceolata*						x	x
Shrub	*Persoonia levis*		x				x	x
Shrub	*Persoonia pinifolia*		x					x
Shrub	*Petrophile pulchella*						x	x
Shrub	*Pimelea linifolia subsp. linifolia*						x	x
Shrub	*Pittosporum revolutum*		x					x
Shrub	*Polyscias sambucifolia ssp sambucifolia*		x				x	x
Shrub	*Pomaderris andromedifolia*						x	x
Shrub	*Prostanthera incisa*		x					x
Shrub	*Prostanthera linearis*						x	x
Shrub	*Pultenaea flexilis*		x			x		x
Shrub	*Pultenaea tuberculata*						x	x
Shrub	*Pultenaea villosa*						x	x
Shrub	*Woolsia pungens*		x					x
Shrub	*Zieria smithii*						x	x
Sub-shrub	*Opercularia aspera*						x	x
Sub-shrub	*Phyllanthus hirtellus*		x					x
Sub-shrub	*Pomax umbellata*						x	x
Sedge	*Caustis flexuosa*					x		x
Sedge	*Gahnia sieberiana*						x	x
Sedge	*Juncus planifolius*					x		x
Sedge	*Juncus usitatus*						x	x

Life Form	Species	Community 6 - Turpentine - Smooth-barked Apple Forest	Community 5 - Blackbutt Open Forest	Community 4 - Rocky Creek Riparian Scrub	Community 3 - Riverflat Scribbly - Peppermint Woodland - Open Forest	Community 2 - Sydney Peppermint Open Forest	Community 1 - Scribbly Gum Woodland	Linksley Ave Bike Track all species
Sedge	*Lepidosperma laterale*						x	x
Sedge	*Lepyrodia scariosa*					x	x	x
Sedge	*Schoenus imberbis*						x	x
Sedge	*Schoenus melanostachys*		x					x
Herb	*Actinotus helianthi*						x	x
Herb	*Ageratina adenophora* *				w			w
Herb	*Dianella caerulea*		x			x		x
Herb	*Dianella prunina*						x	x
Herb	*Dianella revoluta*		x					x
Herb	*Dimorphotheca ecklonis* *						x	x
Herb	*Geranium homeanum*		x					x
Herb	*Hypochoeris radicata* *				w			w
Herb	*Mitrasacme pilosa*						x	x
Herb	*Patersonia sericea*						x	x
Herb	*Plantago lanceolata* *						w	w
Herb	*Plectranthus parviflorus*				x			x
Herb	*Poranthera microphylla*						x	x
Herb	*Pratia purpurascens*						x	x
Herb	*Senecio madagascariensis* *						w	w
Herb	*Tetratheca thymifolia*		x			x		x
Herb	*Tradescantia fluminensis* *	w			w			w
Herb	*Trifolium repens* *		w					w
Herb	*Xanthosia pilosa*		x				x	x
Herb	*Xanthosia tridentata*		x					x
Grass	*Andropogon virginicus* *						w	w
Grass	*Anisopogon avenaceus*						x	x
Grass	*Austrodanthonia sp*						x	x
Grass	*Briza maxima* *						w	w
Grass	*Chloris gayana* *						w	w
Grass	*Cortaderia selloana* *						w	w
Grass	*Echinopogon caespitosus*						x	x
Grass	*Ehrharta erecta* *					w		w
Grass	*Entolasia marginata*					x		x
Grass	*Entolasia stricta*		x			x	x	x
Grass	*Eragrostis curvula* *					w	w	w
Grass	*Imperata cylindrica*				x			x

Life Form	Species	Community 6 - Turpentine - Smooth-barked Apple Forest	Community 5 - Blackbutt Open Forest	Community 4 - Rocky Creek Riparian Scrub	Community 3 - Riverflat Scribbly - Peppermint Woodland - Open Forest	Community 2 - Sydney Peppermint Open Forest	Community 1 - Scribbly Gum Woodland	Linksley Ave Bike Track all species
Grass	*Microlaena stipoides*						x	x
Grass	*Paspalum urvillei* *						w	w
Grass	*Pennisetum clandestinum* *						w	w
Grass	*Sporobolus africanus* *						w	w
Graminoid	*Lomandra longifolia*		x			x	x	x
Graminoid	*Lomandra obliqua*						x	x
Graminoid	*Xanthorrhoea media*		x					x
Fern	*Adiantum aethiopicum*		x					x
Fern	*Calochlaena dubia*	x				x		x
Fern	*Cyathea cooperi*					x		x
Fern	*Gleichenia dicarpa*		x					x
Fern	*Nephrolepis cordifolia* *	w						w
Fern	*Pteridium esculentum*		x					x
Climber	*Acetosa sagittata* *				w			w
Climber	*Araujia sericifera* *				w			w
Climber	*Asparagus asparagoides* *					w	w	w
Climber	*Billardiera scandens*		x			x		x
Climber	*Cardiospermum grandiflorum* *				w			w
Climber	*Cassytha pubescens*						x	x
Climber	*Clematis glycinoides*		x				x	x
Climber	*Hardenbergia violaceae*		x					x
Climber	*Hibbertia scandens*		x					x
Climber	*Kennedia rubicunda*		x			x		x
Climber	*Lonicera japonica* *				w			w
Climber	*Pandorea pandorana*		x					x
Climber	*Passiflora edulis* *		w					w
Climber	*Rubus fruticosis* *				w			w
Climber	*Smilax glyciphylla*		x					x
Climber	*Vicia sativa* *						x	x
Orchids	*Cymbidium suave*					x		x

APPENDIX 5: Assessments of Significance for Flora Issues

A Seven-part Test of Significance has been conducted for each of the following flora species or communities known to occur within the Study Area. The impact of the construction of the cycleway from Linksley Avenue to Rosebery Road will be considered in each assessment.

- Sydney Turpentine Ironbark Forest
- *Epacris purpurascens* var. *purpurascens*
- *Dillwynia biflora*

Sydney Turpentine Ironbark Forest

As required under the NSW (*TSC Act*) and Commonwealth (*EPBC Act*) environmental legislation, Assessments of Significance for Sydney Turpentine Ironbark Forest ('STIF') are provided to assess the impacts of the Proposal on this ecological community.

STIF is listed as a *Critically Endangered Ecological Community* ('EEC') under the Commonwealth *EPBC Act (1999)* and an *Endangered Ecological Community* under the NSW *TSC Act (1995)*

The current Proposal is construct a Cycleway Link between Linksley Avenue Glenhaven and Rosebery Road at Kellyville. The Cycleway route will utilise an already existing bush track between Linksley Avenue and Citadel Crescent and then run along a paved fire trail to Drawbridge Place. The first part of the Cycleway Route traverses the fringes of a stand of STIF, which occurs close to the beginning of the bush track at Linksley Avenue and Timber Grove.

Impacts upon the listed Ecological Community may be Direct Impacts – activities expected to directly affect the listed community e.g. clearing if vegetation, or Indirect Impacts – activities which are expected to affect the listed community indirectly e.g. increases in soil nutrient levels, sedimentation.

The direct impacts on the bushland will depend on the route adopted and the mode of construction used in this first part of the Cycleway route. At the time of writing, the preferred mode of construction is to modify the existing bush track to create a concrete cycleway.

Commonwealth Legislation

Listing advice provided for the Critically Endangered Ecological Community '*Turpentine Ironbark Forest in the Sydney Bioregion*' by the Commonwealth Department of Sustainability, Environment, Water, Population and Community (DEWHA 2005[6]) provides the following information in relation to the required Condition Classes of STIF:

> *The ecological community is limited to remnants that are relatively intact in condition as outlined below:*
>
> 1. *The vegetation contains some characteristic components from all structural layers (tree canopy, small tree/shrub mid-storey, and understorey).*

[6] DEWHA is now known as SEWPAC – Department of Sustainability Environment Water Population & Communities

2. *Tree canopy cover is greater than 10% and remnant size is greater than one (1) hectare. These areas have the greatest conservation value and their high quality and size makes them most resilient to disturbance.*
3. *However, remnants with tree canopy cover less than 10% are also included in the ecological community, if the fragments are greater than one (1) hectare in size and occur in areas of native vegetation in excess of five (5) hectares in area. These areas enhance the potential for connectivity and viability of the ecological community. They support native flora and fauna species by facilitating gene flow among remnants and buffering against disturbance.*

The ecological community as described in the *EPBC Act* specifically excludes patches where either the native mid-storey/understorey or native canopy trees are absent. Occurrences of isolated single trees or shrubs characteristic of the ecological community also are excluded from the ecological community. Although these degraded remnants may have some value as biodiversity reservoirs, the structure of these patches has been so severely modified, that they fall outside the definition of the ecological community.

The small stand of STIF at Linksley Avenue/Timber Grove at Glenhaven is not one (1) hectare or greater in size, occurring as small patches of remnant vegetation on the ridges and upper slopes of the unnamed eastern tributary creek in this part of the Study Area. The large canopy trees *Syncarpia glomulifera* (Sydney Turpentine), are however characteristic of the STIF ecological community and they contribute to a native tree canopy which provides fauna habitat for urban-tolerant species which are known to occur in the Locality and Region.

NSW State Legislative Considerations – the Seven-part Test

An Assessment of Significance ('Seven-part Test') under Section 5A of the *Environmental Planning and Assessment Act 1979* is designed to determine *"whether there is likely to be a significant effect on threatened species, populations, ecological communities or their habitats"* (as listed on the Schedules of the NSW *TSC Act*), and consequently, to determine whether a Species Impact Statement is required (see Final Determination for Sydney Turpentine Ironbark Forest ('STIF') in *Appendix* 3).

The current Proposal is construct a Cycleway Link between Linksley Avenue Glenhaven and Rosebery Road at Kellyville. The Cycleway route will utilise an already existing bush track between Linksley Avenue and Citadel Crescent and then run along a paved fire trail to Drawbridge Place. The first part of the Cycleway Route traverses the fringes of a stand of STIF, which occurs close to the beginning of the bush track at Linksley Avenue and Timber Grove.

The direct impact on STIF will depend on the route adopted and the mode of construction used in this part of the Cycleway route. At the time of writing, the preferred mode of construction is to modify the existing bush track to create a concrete cycleway.

The following Assessment of Significance has been undertaken in relation to the potential impact of the Proposal to construct a Cycleway Link through a small stand of STIF at Linksley Avenue/Timber Grove Glenhaven.

(a)……in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

No threatened species listed under the Schedule 1, Part 1 of the *Threatened Species Conservation Act* 1995 (*TSC Act*) were recorded in or directly adjacent to the stand of SIF in the Study Area. Therefore the Proposal will not disrupt the lifecycle of a viable threatened species such that it would be significantly compromised.

(b) …. *in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction*

No endangered populations listed on Schedule 1 (Part 2) of the NSW *TSC Act* were recorded within or directly adjacent to the Study Area. Therefore, the Proposal will not disrupt the lifecycle of a viable threatened species population such that it would be significantly compromised.

(c)….*in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The proposed Cycleway Link will be located over an existing bush track, which itself has been formed over the sewer line easement on the eastern side of an unnamed tributary of Cattai Creek. The bush track is 1.5-2 metres in width and extends from Linksley Avenue/Timber Grove to Citadel Crescent.

The subject stand of STIF is confined to a very small area along the upper creekbanks at the beginning of the bush track, and does not extent to Citadel Crescent (see *Figure 2.3*) of this Report. The narrow bush track is a long-standing structure (estimated to be 15-20 years) along the unnamed eastern tributary and serves to provide an area of passive recreation for local residents.

The Proposal will not reduce the extent of the STIF ecological community as the ecological community occurs on the upper banks and the bush track is on the lower slopes close to the creek. Therefore no part of the ecological community will be removed or otherwise damaged, and there is not expected to be any direct or indirect impacts on this remnant as a result of the Proposal. Therefore it is considered that the Proposal will not contribute to placing this Endangered Ecological Community (EEC) at further risk of extinction, and no reduction in extent of this community within the Locality is expected.

(ii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*,

The STIF ecological community occurs on the upper banks of the unnamed eastern tributary creek while the bush track is on the lower slopes close to the creek; traversing an area described as Sydney Sandstone Gully Forest. No trees are to be removed within the Study Area and no direct or indirect impacts are anticipated under the Proposal. Therefore it is considered that the Proposal would not substantially or adversely modify the composition of the STIF ecological community such that it would be placed at the risk of extinction.

(d)….*in relation to the habitat of a threatened species, population or ecological community:*

(i)... the extent to which habitat is likely to be removed or modified as a result of the action proposed,

The Cycleway Link will utilise the footprint of the existing bush track in this first section of the route, which is already cleared to a width of 1.5 to 2 metres. The Cycleway will follow the 'line of best fit' and no indigenous trees are to be removed as part of the Proposal. Minor encroachment into bushland on either side of the bush track may be necessary to stabilise track edges and/or to provide protection for geological features and trees. However, no area of STIF is likely to be significantly impacted. Therefore the Proposal is therefore unlikely to modify existing habitat within this stand of the STIF ecological community.

(ii)… whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action,

The Cycleway Link will utilise the footprint of the existing bush track in this first section of the route, an area which is already cleared. *Syncarpia glomulifera* (Sydney Turpentine) occur on both sides of the unnamed eastern tributary creek, but these characteristic STIF trees do not extend further downstream where the vegetation is mapped as Hinterland Sandstone Gully Forest and as Riparian Scrub (both communities are based on sandstone geology, not shale).

STIF in the Locality is already fragmented by roads and residential development of some years standing. Connectivity via the canopy occurs through a number of large trees in the gully and other trees on neighbouring streets and in private properties. All STIF trees are to be retained and are unlikely to be impacted under the Proposal. The Proposal is therefore unlikely to result in any area of habitat being further fragmented or isolated from other areas of habitat.

(iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*,

Stands of *Syncarpia glomulifera* (Sydney Turpentine) occur on the upper slopes on both sides of the gully of the unnamed eastern tributary creek. As the existing bush track (whether to be upgraded or paved) does not traverse though an area of STIF bushland. The Cycleway Link will utilise the footprint of the existing bush track in this first section of the route, an area which is already cleared.

The canopy layer provided by the remnant STIF tree species on the slopes provides habitat for a variety of urban-tolerant native and introduced fauna, especially birds and arboreal mammals, and possibly microbats. However, the habitat provided by these large canopy trees is not unique, and similar habitat is provided by other large trees within the Study Area and by numerous other trees on neighbouring properties and those planted as street trees.

None of these trees will be removed or impacted upon by the Proposal.

(e) ….whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No habitats considered critical to threatened plant species, populations or ecological communities previously recorded in the Region occur within, or in close proximity to the Study Area.

The Study Area is not listed as 'critical habitat' under Part 3 Division 1 of the *TSC Act*.

(f)……whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No Recovery Plans or Threat Abatement Plans (either finalised or draft) are relevant to the STIF within the Study Area, Locality or Region.

(g)…..whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The KTP 'clearing of native vegetation' may be applicable to the Proposal to create a Cycleway Link over an existing bush track. Minor clearing on track edges may be required, although it is not known at this time how much area will be impacted.

None of the other identified Key Threatening Processes[7] listed under Schedule 3 of the *TSC Act*, would be applicable to this Proposal.

However, one Key Threatening Process that may be relevant, particularly if machinery hygiene is not adequate, is infection by the soil pathogen *Phytophtohora cinnamomi*. In order to guard against this KTP, it is recommended that all machinery entering the site be thoroughly cleared, especially if such machinery has been used in weedy or otherwise contaminated sites previously.

Further, all native canopy trees along the existing bush track in this part of the Study Area will be protected during construction works. Of particular importance is the prevention of movement by soil and/or water from the construction site downslope into the bushland and the nearby watercourse (the unnamed eastern tributary creek) as this could introduce *Phytophtohora cinnamomi* activated by earthworks.

Therefore, giving consideration to Section 5(A) of the State *Environmental Planning and Assessment Act* 1979, it is considered that the matter WOULD NOT require a referral to the Director General Environment & Heritage and the preparation of a Species Impact Statement for Sydney Turpentine Ironbark Forest

Epacris purpurascens var. *purpurascens*

NSW State Legislative Considerations

A Seven-part Test of Significance under Section 5A of the *Environmental Planning and Assessment Act 1979* is designed to determine "whether there is likely to be a significant effect on threatened species, populations, ecological communities or their habitats" (as listed on the Schedules of the NSW *TSC Act*), and consequently to determine whether a Species Impact Statement is required.

The current Proposal is construct a Cycleway Link between Linksley Avenue Glenhaven and Rosebery Road at Kellyville. The Cycleway route will utilise an already existing bush track between Linksley Avenue and Citadel Crescent (Section 1) and then run along a paved fire trail to Chainmail Crescent

[7] Key Threatening Process has the same meaning as in the NSW *TSC Act* subject or to section 5C, Part 7A of the NSW *Fisheries Management Act 1994.*

(Section 2). Stage 3 of the Cycleway Link from Chainmail Crescent to a point approximately opposite the end of Rosebery Road (on the far side of Cattai Creek) will be constructed at a later date.

Epacris purpurascens var. *purpurascens* has been recorded for bushland in the current Study Area: two (2) specimens in Stage 1 and one (1) specimen in Stage 2 (see *Figure 3.1*). *Epacris purpurascens* var. *purpurascens* is a threatened shrub listed under the *TSC Act*; therefore carrying out this Test is a requirement of the legislation.

The direct impact on the threatened Epacris will depend on the final width of the Cycleway Link (as modified) and the mode of construction. At the time of writing, the preferred mode of construction is to modify the existing unmade bush track between Linksley Avenue/Timber Grove and Citadel Crescent to create a concrete cycleway. The existing paved fire trail will be upgraded where necessary and erosion points repaired, but it will remain substantially unchanged.

The following Assessment of Significance has been undertaken in relation to the potential impacts of the Cycleway Link Proposal on the threatened *Epacris purpurascens* var. *purpurascens* which occurs in Section 1 (Linksley Avenue/Timber Grove to Citadel Crescent, and Section 2 (Citadel Crescent to Chainmail Crescent. There were no threatened species recorded for Stage 3 (Chainmail Crescent to a point opposite and/or downstream of Rosebery Road).

Epacris purpurascens var. purpurascens

(a)… in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

A threatened plant – *Epacris purpurascens* var. *purpurascens* – has been recorded within the Study Area. Three (3) individuals were recorded in close proximity to the existing bush track (Stage 1) and adjacent to the existing fire trail (Stage 2) (see *Figure 3.1*). As suitable habitat is found elsewhere in the Study Area, t is likely that other plants occur in bushland on the slopes away from the existing track and fire trail.

As these three (3) individuals are growing in close proximity to the existing track and fire trail, unless protective measures are taken it is possible that these plants will be damaged during construction of the Cycleway Link.

In preparing this Assessment, it has been assumed that measures will be set in place to protect the threatened Epacris (including temporary fencing and notification to contractors). Ideally, no works should be undertaken within three to five metres of the Epacris, although it is recognised that this may not be possible. Given this assumption, and given that other plants are likely to occur in the local bushland, the proposed Cycleway Link development is not expected to cause the local extinction of the species.

(b)… in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

No endangered flora populations listed on Schedule 1 (Part 2) of the NSW *TSC Act* were recorded within the Study Area. Therefore, the proposed Cycleway Link development is not

expected to disrupt the lifecycle of a viable threatened species population such that it would be significantly compromised.

(c)… in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i)… is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

A threatened ecological community listed under the *TSC Act* (STIF) was recorded within the Study Area. This has been considered in a separate Seven-part Test.

(ii)… is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

See Part c(i).

(d)… in relation to the habitat of a threatened species, population or ecological community:

(i)… the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The existing bush track and paved fire trail have been in place for some years (at least 15-20 years). These tracks have been cleared of native vegetation and maintained as open thoroughfares through constant use by pedestrians and cyclists. The fire trail is also maintained by Council staff.

With the exception of small edge sites along the bush track which might be impacted by the need to reinforce edges and/or protect geological features and large trees, no clearing of the threatened Epacris habitat is anticipated. Modification is therefore expected to be minimal.

It is acknowledged that runoff from the paved (concrete) surface in Section 1 of the route may increase soil moisture levels on track edges, but as the recorded Epacris individuals are growing upslope of the bush track and fire trail, no such impact is anticipated.

As mentioned previously in Part (*a*), it is expected that the *Epacris purpurascens* var. *purpurascens* recorded in close proximity to the existing bush track and fire trail will protected by creating a protective "Conservation Zone" around each plant, and that no intrusion into these Zones will be allowed.

(ii) …whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The existing bush track and paved fire trail have been in place for some years (at least 15-20 years). These tracks have been cleared of native vegetation and maintained as open thoroughfares through constant use by pedestrians and cyclists. The fire trail is also maintained by Council staff.

The three (3) Epacris individuals recorded for the Study Area were found growing upslope of the bush track and fire trail, in areas where no further vegetation clearing is anticipated: as such, no fragmentation of habitat is anticipated

(iii)… the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

As mentioned above, the three (3) Epacris individuals recorded for the Study Area were found growing upslope of the bush track and fire trail, in areas where no further vegetation clearing is anticipated: as such, no fragmentation of habitat is anticipated.

As the route of the proposed new Cycleway Link has already been cleared for some years (Stage 1 – unmade bush track; Stage 2 -paved fire trail), no further areas of habitat or potential habitat will be impacted, and no area of habitat will be removed, modified, fragmented or isolated as the result of the Proposal.

(e) …whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No habitats considered critical to *Epacris purpurascens* var. *purpurascens* occur within, or in close proximity to, the Study Area. Land in the Cattai Creek Riparian Corridor is not listed as 'critical habitat' under Part 3 Division 1 of the *TSC Act*.

(f) …whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No Recovery Plans or Threat Abatement Plans (both finalised and draft) are relevant to the *Epacris purpurascens* var. *purpurascens* within the Study Area. Many of the priority actions that have been determined by the DEC[8] (2006) for the management of *Epacris purpurascens* var. *purpurascens* are already being implemented.

The recovery strategies for the species recommended by DECC (2007) are:

- Fire intervals of 10-15 yrs (where there are no needs for asset protection zones); and
- Prevent further loss and fragmentation of habitat.

The recommended fire intervals would be very difficult to implement due to the presence of residential housing on both sides of the Riparian Corridor.

(g) …whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the identified Key Threatening Processes listed under Schedule 3 of the *TSC Act*, "clearing of native vegetation" would not be applicable as the level of native vegetation clearance proposed is minimal and will be restricted to edge sites (where necessary). Provided that protective measures are set in place to identify and exclude access to the three (3) threatened Epacris recorded along the Cycleway Link route, there will be no adverse effect on the local population of *Epacris purpurascens* var. *purpurascens*.

There are several Key Threatening Processes that may be relevant to the associated works, particularly if machinery hygiene is not sufficient and disease and/or weed seed is imported into the subject site.

[8] Now DECC

These Key Threatening Processes include: infection by *Phytophtohora cinnamomi*; infestation by exotic perennial grasses, exotic vines and scramblers, Lantana or Bitou Bush/Boneseed.

To avoid these threatening processes, machinery will need to be cleaned prior to working in areas that are in, or adjacent to native vegetation.

The control of weeds (especially woody weeds) also forms part of the recovery strategy plan for *Epacris purpurascens* var. *purpurascens.* UBM recommends that targeted weed control/bush regeneration works along the route of the Cycleway Link be undertaken prior to the commencement of construction. The location of Linksley Road at the head of a small sub-catchment of Cattai Creek provides an ideal opportunity to control weeds and protect local biodiversity values.

Therefore, giving consideration to the requirements of the NSW *Environmental Planning and Assessment Act* 1979, it is considered that the matter would NOT require referral to the Director General Environment & Heritage and the preparation of a Species Impact Statement for *Epacris purpurascens* var. *purpurascens*.

Darwinia biflora

NSW State Legislative Considerations

A Seven-part Test of Significance under Section 5A of the *Environmental Planning and Assessment Act 1979* is designed to determine "whether there is likely to be a significant effect on threatened species, populations, ecological communities or their habitats" (as listed on the Schedules of the NSW *TSC Act*), and consequently to determine whether a Species Impact Statement is required.

The current Proposal is construct a Cycleway Link between Linksley Avenue Glenhaven and Rosebery Road at Kellyville. The Cycleway route will utilise an already existing bush track between Linksley Avenue and Citadel Crescent (Section 1) and then run along a paved fire trail to Chainmail Crescent (Section 2). Stage 3 of the Cycleway Link from Chainmail Crescent to a point approximately opposite the end of Rosebery Road (on the far side of Cattai Creek) will be constructed at a later date.

A population of about 50 individuals of *Darwinia biflora* has been recorded in Stage 2 of the current Study Area; located in bushland on the south-western side of the fire trail which runs behind Ridgecrop Drive (see *Figure 3.1*). *Darwinia biflora* is a shrub listed as *'Vulnerable'* under both the *TSC and EPBC Acts;* therefore carrying out an Assessment of Impacts is a requirement of the legislation.

The impacts of the Proposal on the population of *Darwinia biflora* in bushland along the paved fire trail are expected to be minimal, and given their location away from the fire trail, probably will not occur at all. The existing paved fire trail will be upgraded where necessary and erosion points repaired, but it will remain substantially unchanged.

The following Assessment of Significance has been undertaken in relation to the potential impacts of the Cycleway Link Proposal on the vulnerable shrub Darwinia biflora *which occurs in* Section 2 (Citadel Crescent to Chainmail Crescent) of the proposed Cycleway Link in the Cattai Creek Riparian Corridor. Darwinia biflora was not recorded in either of Stage 1 or 3 of the proposed Cycleway route.

NOTE: UBM has not carried out the Assessment under the Commonwealth EPBC Act Assessment Guidelines as the species is considered not to be in the area likely to be impacted. The relevant issues are adequately addressed in the Seven-part Test (below).

Darwinia biflora – a vulnerable shrub

(a)… in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Darwinia biflora, listed as 'vulnerable' has been recorded within the Study Area. A large population of about 50 individuals occurs in bushland on the south-western side of the existing fire trail which runs behind Ridgecrop Drive (see *Figure 3.1*). As suitable habitat is found elsewhere in the Study Area, it is possible that other plants are present, although they would more likely occur closer to the ridgelines, on the shale soil geology).

As the population of *Darwinia biflora* is not found on the edges of the fire trail, but further away in undisturbed bushland, it is unlikely that upgrading of or repairs to the fire trail will impact on the extant population.

Nevertheless, in preparing this Assessment, it has been assumed that measures will be set in place to protect the threatened *Darwinia* (including temporary fencing and notification to contractors). Ideally, no works should be undertaken within three to five metres of the Darwinia. Given this assumption, and given that other plants are likely to occur in the local bushland, the proposed Cycleway Link Proposal is not expected to cause the local extinction of the species.

(b)… in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

A species listed as 'vulnerable', *Darwinia biflora,* has been recorded within the Study Area. A large population of about 50 individuals occurs in bushland on the south-western side of the existing fire trail which runs behind Ridgecrop Drive (see *Figure 3.1).* As suitable habitat is found elsewhere in the Study Area, it is possible that other plants are present, although they would more likely occur closer to the ridgelines, at the interface of the sandstone and shale geology.

As the population of *Darwinia biflora is* not found on the edges of the fire trail, but further away in undisturbed bushland, it is unlikely that upgrading of or repairs to the fire trail (where required) will impact on the extant population.

No endangered flora populations listed on Schedule 1 (Part 2) of the NSW *TSC Act* were recorded within the Study Area. Therefore, the proposed Cycleway Link development is not expected to disrupt the lifecycle of a viable threatened species population such that it would be significantly compromised.

(c)… in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i)… is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

A threatened ecological community listed under the *TSC Act* (STIF) was recorded within the Study Area. This has been considered in a separate Seven-part Test.

(ii)… is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

See Part c(i).

(d)… in relation to the habitat of a threatened species, population or ecological community:

(i)… the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The paved fire trail has been in place for some years (at least 15-20 years). The fire trail is formed of decomposed granite and has been cleared for a width of 4-5 metres. It is maintained by Council staff.

With the exception of some site where minor repairs are needed to attend to erosion points or 'blowouts' near drainage lines, no construction work is proposed for the fire trail. The existing decomposed granite surface is in good repair, and there is at this time, no proposal to concrete the surface. The Cycleway Link at this point will not impact on the population of *Darwinia biflora*.

Nevertheless, it is expected that the population of *Darwinia biflora* on the south-west side of the fire trail will protected by creating a protective "Conservation Zone" around the population, and that no intrusion into this Zone will be allowed.

(ii) …whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The existing bush track from Linksley Avenue and the paved fire trail behind Ridgecrop Drive have been in place for some years (at least 15-20 years). These tracks have been cleared of native vegetation and maintained as open thoroughfares through constant use by pedestrians and cyclists. The fire trail is maintained by Council staff.

The population of *Darwinia biflora* growing on the south-western side of the fire trail is located in bushland; not on the track edges. Therefore any damage to these plants is unlikely. As no vegetation clearing in the vicinity of the population will occur, no fragmentation or isolation of habitat is anticipated

(iii)… the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

As mentioned above, the population of *Darwinia biflora* recorded for the Study Area was found growing on the south-western side of the existing fire trail, in areas where no vegetation clearing will occur: as such, no fragmentation of habitat is anticipated.

As the route of the proposed new Cycleway Link has already been cleared for some years, no further areas of vegetation will be impacted, and no area of habitat will be removed, modified, fragmented or isolated as the result of the Proposal.

(e) …whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No habitats considered critical to the survival of *Darwinia biflora* occur within, or in close proximity to, the Study Area. Land in the Cattai Creek Riparian Corridor is not listed as 'critical habitat' under Part 3 Division 1 of the *TSC Act*.

(f) …whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The Approved Recovery Plan for *Darwinia biflora* has been prepared by the former Department of Environment & Conservation (2004). Many of the priority actions determined by DEC[9] (2004) for the recovery and management of *Darwinia flora* are already being implemented (e.g. legislative protection of known sites, appropriate management).

Fire is an important factor in the life cycle of this species. Fire kills all plants, but also produces a flush of germination from seed stored in the soil. The number of individuals at a site will decline with time since fire, as the surrounding vegetation develops. The fire regime for the management of native vegetation in the Cattai Creek Riparian Corridor is not known.

(g) …whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

There is one (1) KTP directly relevant to the associated works, particularly if vehicles and other machinery hygiene are inadequate and disease and/or weed seed is imported into the Study Area. This is infection of tree and shrubs by the root rot fungus *Phytophthora cinnamomi.*

To avoid this KTP, vehicles and machinery will need to be cleaned prior to working in areas that are in, or adjacent to native vegetation.

The control of weeds (especially woody weeds) also forms part of the recovery strategy plan for *Darwinia biflora.* UBM recommends that targeted weed control/bush regeneration works along the route of the Cycleway Link be undertaken prior to the commencement of construction.

Therefore, giving consideration to the requirements of the NSW *Environmental Planning and Assessment Act* 1979, it is considered that the matter would NOT require referral to the Director General Environment & Heritage and the preparation of a Species Impact Statement for *Darwinia biflora*.

[9] Now DECC

APPENDIX 6: Assessments of Significance for Fauna Issues

The cycleway construction in Sections 1 and 2 (see *Figure 3.2*) are not expected to have any significant impact on adjacent bushland. The proposed cycleway in Section 3 will be approximately 250 meters in length and impact on less than one (1) hectare of native vegetation.

As such, an Assessment using the criteria ('Seven-part Test') provided under Section 5A of the *Environmental Planning and Assessment Act 1979* has been undertaken for this species. These criteria are used to determine "whether there is likely to be a significant effect on this species, its populations, ecological communities or habitats", and consequently whether a Species Impact Statement is required.

Each Seven-part Test of Significance for the following fauna species considers the impact of the construction of a cycleway from Linksley Avenue Glenhaven to Rosebery Road at Kellyville. Some species have been combined based on their similar habitat requirements.

- Little Lorikeet (*Glossopsitta pusilla*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- Powerful Owl (*Ninox strenua*)
- Microbats: Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)and Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)

Little Lorikeet

The **Little Lorikeet** (***Glossopsitta pusilla***) is listed as 'Vulnerable' under Schedule 2 of the *TSC Act.* Two (2) individuals were observed in the tree canopy above the Study Area and a potential nest in a tree hollow was indentified in Section 3 of the Study Area.

The Little Lorikeet forages primarily in the canopy of open Eucalypt forests and woodlands and is often found in riparian habitats. Nesting sites are small hollows positioned high above the ground, usually in smooth-barked Eucalypts. Repeated use of nesting sites suggests there are few available.

(a) "…in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction…"

> There are suitable nesting and foraging sites available for the Little Lorikeet in the vegetation along the length of the cycleway. The cycleway construction will impact on less than 1 ha of bushland considered of value to the Little Lorikeet. It is not anticipated that any hollow-bearing trees (and therefore nesting sites) will be removed. The remainder of the bushland in the Locality will remain unaffected, making the cycleway construction unlikely to place the species at risk of extinction.

(b) "…in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction…"

An endangered population is defined under the *TSC Act* as 'a population specified in Part 2 of Schedule 1'. At the present time, there are no endangered populations of this species listed under the Act.

(c) "…in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) ..is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii).. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction..."

An Endangered Ecological Community means an ecological community specified in Part 3 of Schedule 1 of the *TSC Act*. Therefore, not applicable to a threatened species.

(d) "…in relation to the habitat of a threatened species, population or ecological community:

(i)... the extent to which habitat is likely to be removed or modified as a result of the action proposed…", and

(ii) … whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action…, and

(iii)…the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality…

The cycleway construction will impact less than 1 ha of native bushland that could be considered of value to the Little Lorikeet but it will retain the remaining bushland considered to be of equal value. Vegetation removal for the cycleway construction will not prevent the Little Lorikeet from moving along the Cattai Creek riparian corridor. The removal of this small area (<1 ha) of bushland within the Study Area is unlikely to impact on the long-term survival of the Little Lorikeet within the Locality or Region.

(e) "…whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)…"

The Study Area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*. Therefore, no critical habitat would be adversely affected by the Proposal.

(f) "…whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan…"

No Recovery Plans or Threat Abatement Plans (either finalised or draft) have been prepared for the Little Lorikeet.

(g) "…whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process..."

Currently 27 Key threatening processes are defined under Schedule 3 of the *TSC Act*. The Proposal would include the clearing of an area of native vegetation (<1ha); this being listed as a Key Threatening Process.

The effects of other key threatening processes such as the introduction and spread of weeds such as Lantana, exotic vines, perennial grasses, vines and scramblers should be kept to a minimum.

It is recommended that the largest possible area of bushland within the Study Area remains undisturbed to minimise the impact of key threatening processes.

Expected impact on the Little Lorikeet

The cycleway construction will remove a small amount of habitat (<1 ha) that could be utilised by the Little Lorikeet for nesting and foraging. The remainder of the bushland within the Study Area, also considered of value to the species, will remain unaffected.

Given the small area of vegetation to be removed, and the much large area of vegetation available, it is unlikely that the cycleway construction will have a detrimental effect on Little Lorikeet individuals or populations that may utilise the Study Area.

It is not considered that the proposed construction of a Cycleway Link between Linksley Avenue and Rosebery Road would have a significant impact on the Little Lorikeet, its populations or habitats. Therefore, the preparation of a Species Impact Statement that further considers the impacts of the cycleway construction on these species is NOT REQUIRED.

Varied Sittella

The **Varied Sittella** (*Daphoenositta chrysoptera*) is listed as 'Vulnerable' under Schedule 2 of the NSW *TSC Act 1995*. Although not detected in the current field investigations, there are records of the species occurring within one (1) kilometre of the Study Area.

The Varied Sittella is sedentary, inhabiting eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland (OEH 2012). They build nests high in the tree canopy and often use the same nesting site in successive years.

(a) "…in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction…"

There are suitable nesting and foraging sites available for the Varied Sittella in the vegetation along the length of the cycleway. The cycleway construction will impact on less than 1 ha of bushland considered of value to the Varied Sittella. The remainder of the bushland in the Locality will remain unaffected, making the cycleway construction unlikely to place the species at risk of extinction.

(b) "…in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction…"

An endangered population is defined under the *TSC Act* as 'a population specified in Part 2 of Schedule 1'. At the present time, there are no endangered populations of this species listed under the Act.

(c) "…in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) ..is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii).. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction..."

An Endangered Ecological Community means an ecological community specified in Part 3 of Schedule 1 of the *TSC Act*. Therefore, not applicable to a threatened species.

(d) "…in relation to the habitat of a threatened species, population or ecological community:

(i)... the extent to which habitat is likely to be removed or modified as a result of the action proposed…", and

(ii) … whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action…, and

(iii)…the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality…

The cycleway construction will impact less than 1 ha of native bushland that could be considered of value to the Varied Sittella but it will retain the remaining bushland considered to be of equal value. Vegetation removal for the cycleway construction will not prevent the Varied Sittella from moving along the Cattai Creek riparian corridor. The removal of this small area (<1 ha) of bushland within the Study Area is unlikely to impact on the long-term survival of the Varied Sittella within the Locality or Region.

(e) "…whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)…"

The Subject Property is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*. Therefore, no critical habitat would be adversely affected by the Proposal.

(f) "…whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan…"

No Recovery Plans or Threat Abatement Plans (either finalised or draft) have been prepared for the Varied Sittella.

(g) "…whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process..."

Currently 27 Key threatening processes are defined under Schedule 3 of the *TSC Act*. The Proposal would include the clearing of an area of native vegetation (<1ha); this being listed as a Key Threatening Process.

The effects of other key threatening processes such as the introduction and spread of weeds such as Lantana, exotic vines, perennial grasses, vines and scramblers should be kept to a minimum.

It is recommended that the largest possible area of bushland within the Study Area remains undisturbed to minimise the impact of key threatening processes.

Expected impact on the Varied Sittella

The cycleway construction will remove a small amount of habitat (<1 ha) that could be utilised by the Varied Sittella for nesting and foraging. The remainder of the bushland within the Study Area, also considered of value to the species, will remain unaffected.

Given the small area of vegetation to be impacted (<1 ha), and the much large area of vegetation to be retained, it is unlikely that the draft Proposal will have a detrimental effect on Varied Sittella individuals or populations that may use the Study Area.

It is not considered that the proposed construction of a Cycleway Link between Linksley Avenue and Rosebery Road would have a significant impact on the Varied Sittella, its populations or habitats. Therefore, the preparation of a Species Impact Statement that further considers the impacts of the cycleway construction on these species is NOT REQUIRED.

Powerful Owl

The **Powerful Owl** (*Ninox strenua*) is listed as 'Vulnerable' under Schedule 2 of the NSW *TSC Act 1995*. There are records of the species occurring less than one (1) km from the Study Area.

Tree hollows are particularly important for all forest owl species. They not only provide habitat for hollow-dwelling arboreal marsupials (possums and gliders), which comprise a large proportion of the owl's diet, but are also potential nesting sites. Estimates of the home range of the Powerful Owl are between 400 – 1450 hectares (OEH 2012).

(a) "…in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction…"

There is some potential for the Powerful Owl to utilise the resources of the Study Area for hunting and nesting. The proposed cycleway construction in Section 3 will impact on less than one (1) hectare of native vegetation. The proposed subdivision is not likely to impact on populations of suitable prey (prey species including possums, rabbits and birds). Due to the high mobility and large home range of the Powerful Owl, it is unlikely the cycleway construction will

have an adverse effect of the life cycles or place any local populations of the Powerful Owl at risk of extinction.

(b) "…in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction…"

An endangered population is defined under the *TSC Act* as 'a population specified in Part 2 of Schedule 1'. The Powerful Owl is not listed as an endangered population.

(c) "…in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) ..is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii).. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction..."

An Endangered Ecological Community means an ecological community specified in Part 3 of Schedule 1 of the *TSC Act*. Therefore, not applicable to this threatened species.

(d) "…in relation to the habitat of a threatened species, population or ecological community:

(i)... the extent to which habitat is likely to be removed or modified as a result of the action proposed…", and

(ii) … whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action…, and

(iii)…the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality…

The cycleway construction will impact on less than 1 ha of native vegetation considered of value to the Powerful Owl. The removal of this area of potential habitat is unlikely to impact on the long-term survival of the Powerful Owl within the Locality or Region.

(e) "…whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)…"

The Study Area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*. Therefore, no critical habitat would be adversely affected by the Proposal.

(f) "…whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan…"

A Recovery Plan has been developed for large Forest Owls (including the Powerful Owl). Two (2) of the main issues identified in these Recovery Plans are clearing and fragmentation of habitat.

The construction of the cycleway is not expected to have a significant impact on the resources available to the Forest Owls as other areas of hunting habitat are available in the Locality and

Region. The remained of the bushland in the Cattai Creek riparian zone will remain intact and it is not expected that any large hollow-bearing trees will be removed.

To date, there is no threat abatement plan for the Powerful Owl.

(g) "…whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process…"

Currently 32 Key threatening processes are defined under Schedule 3 of the *TSC Act*. The cycleway construction would impact on less than 1 hectare of native vegetation. Clearing of native vegetation is listed as a Key Threatening Process).

Care should be taken in cycleway construction so that other key threatening processes such as the introduction and spread of weeds such as Bitou Bush, Lantana, exotic vines and scramblers are accelerated. The existing vegetation along Cattai Creek is degraded and infested with woody weeds such as privet.

No other key threatening processes are relevant to the protection of the threatened Owls which might utilise the resources of the Study Area for hunting or nesting purposes.

It is recommended that the smallest possible area of native vegetation is impacted during cycleway construction to minimise the impact of key threatening processes.

Expected impact on Forest Owls

The construction of a cycleway from Linksley Avenue to Rosebery Road is expected to impact on less than one (1) hectare of native vegetation. It is not anticipated that any hollow-bearing trees will be removed. The remainder of the bushland along the length of the cycleway will not be impacted.

Due to the high mobility and large home range of Powerful Owl, which will allow them to hunt over a wide area, it is unlikely these events with have a significant detrimental effect on the Powerful Owl individuals or populations that have potential to use the resources of the Study Area.

It is not considered that the proposed construction of a Cycleway Link between Linksley Avenue and Rosebery Road would have a significant impact on the Powerful Owl, its populations or habitats. Therefore, the preparation of a Species Impact Statement that further considers the impacts of the cycleway construction on these species is NOT REQUIRED.

Microchiropteran Bats

The **Eastern Bentwing-bat** (*Miniopterus schreibersii oceanensis*), **Eastern False Pipistrelle** (*Falsistrellus tasmaniensis*) and **Eastern Freetail-bat** (*Mormopterus norfolkensis*) have been grouped on the basis of their similar habitat requirements. All species are listed as 'Vulnerable' under Schedule 2 of the *TSC Act 1995*. Only the Eastern Bentwing-bat was detected during the current field investigations, however, there is potential that other species may also utilise the resources of the Study Area on occasion. Each of these species has been recorded previously within 2 km of the Study Area.

These three (3) species of microchiropteran bats ('microbats') are insectivorous, and generally occur in tall woodland (forest) habitats. Potential foraging habitat for these species occurs along the length of the Study Area.

The construction of the cycleway is likely to impact on less than one (1) ha of potential foraging habitat for these microbat species as well as some trees with stringy or fibrous bark suitable for the roosting needs of the Eastern Freetail-bat. Some of these trees may contain small hollows or scars which may be utilised by these microchiropteran species. It is expected that no large hollow-bearing trees will be removed. Some caves and rock crevices suitable for the nesting of the Eastern Bentwing-bat or Greater Broad-nosed Bat were recorded within or nearby the Study Area.

(a) "…in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction…"

Microbats were detected utilising the Study Area for foraging purposes, mainly on edge sites or in 'flyways' created by openings or tracks through the bushland.

It is expected that post-construction, these species would to continue forage in the Study Area, utilising much the same habitat types as previously. Given the small area of vegetation to be impacted (<1ha) and the species' high mobility, it is unlikely that the cycleway construction would have a significant impact on a viable local population of these microchiropteran bats.

Some of the small hollows and tree scars may provide suitable roosting habitat for the Eastern Freetail-bat; however, there are a number of other suitable habitat trees available in the portion of bushland to be retained.

(b) "…in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction…",

An endangered population is defined under the *TSC Act* as 'a population specified in Part 2 of Schedule 1'. At the present time, there are no endangered populations of microchiropteran bat species listed under the Act.

(c) "…in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i)... is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii)... is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction..."

Not applicable to a threatened species.

(d) "…in relation to the habitat of a threatened species, population or ecological community:

(i) ...the extent to which habitat is likely to be removed or modified as a result of the action proposed…", and

The cycleway construction will impact on less than 1 ha of native vegetation within which there are trees with fibrous or stringy bark and small hollows which may potentially be used by microchiropteran bats as habitat. Other trees would be used for foraging purposes on occasion although it is anticipated that no large hollow-bearing trees will be removed.

The remainder of the vegetation adjacent to the cycleway route provides suitable habitat for the threatened microbats and will not be impacted during the construction process.

(ii) "… whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action…", and

Microchiropteran bats can easily negotiate open areas and given the limited size of the habitat to be cleared (<1ha), this loss is not expected to result in the disturbance to the bats' foraging patterns. The possible roosting (i.e. hollows for the Eastern Freetail-bat) and foraging sites within the Study Area will still be connected to other foraging and roosting in the Locality and Region.

(iii) "…the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality…"

The clearing of less than 1 ha of bushland within the Study Area will remove some trees with fibrous or stringy bark and others with small scars or hollows that may be used for roosting, by the threatened microbats.

Although this area of potential foraging habitat would be removed for the cycleway construction, this vegetation is part of network of riparian corridors along the Cattai Creek catchment. Given the extent of the resources to be retained in the Study Area and beyond, it is not considered that the Proposal would affect these species such that there would be an impact on their long term survival.

(e) "…whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)…"

No critical habitat would be adversely affected by the draft Proposal. The Study Area is not listed as critical habitat under Part 3 Division 1 of the *TSC Act*.

(f) "…whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan…"

No Recovery Plans or Threat Abatement Plans (either finalised or draft) have been prepared for the Eastern Bentwing-bat, Eastern False Pipistrelle or Eastern Freetail-bat. However, DECCW has identified a number of priority actions for these species (DECCW 2009b).

Of these, the following may be relevant:

- Retain stands of native vegetation (Medium Priority).

The recommendation of this report to minimise the impacts of the cycleway construction is consistent with the objectives of the priority actions.

(g) "…whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process..."

Currently 27 Key threatening processes are defined under Schedule 3 of the *TSC Act*. The Proposal would include the clearing of an area of native vegetation (<1ha); this being listed as a Key Threatening Process.

The effects of other key threatening processes such as the introduction and spread of weeds such as Lantana, exotic vines, perennial grasses, vines and scramblers should be kept to a minimum.

It is recommended that the largest possible area of bushland within the Study Area remains undisturbed to minimise the impact of key threatening processes.

Expected impact on Microchiropteran Bats

Potential foraging and roosting habitat for these bat species occurs along the length of the cycleway. There are trees with fibrous or stringy bark present, as well as many trees with scars and/or small hollows which may serves as potential roosting habitat for the Eastern Freetail-bat.

The cycleway construction will impact on less than 1 ha of native vegetation with the remainder of the surrounding bushland remaining unaffected. Considering the potential available within the Locality, the cycleway construction is not considered to have a significant impact on the local status of the three (3) threatened microchiropteran bats.

It is not considered that the proposed construction of a cycleway between Linksley Avenue and Rosebery Road would have a significant impact on the Eastern Bentwing-bat, Eastern False Pipistrelle or Eastern Freetail-bat, their populations or habitats. Therefore, the preparation of a Species Impact Statement that further considers the impacts of the Cycleway Link on these species is NOT REQUIRED.

Grey-headed Flying Fox

The **Grey-headed Flying-fox** (*Pteropus poliocephalus*), is listed as 'Vulnerable' under Schedule 2 of the NSW *TSC Act 1995* and the Commonwealth *EPBC Act 1999*. Although no Grey-headed Flying-foxes were recorded within the Study Area, it is possible that this species would utilise the resources of the Study Area when local eucalyptus trees are in flower; this being a primary food source for this species. The Grey-headed Flying-fox has previously been recorded less than 1km from the Study Area.

(a) *"…in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction…"*

The cycleway construction is expected to impact on less than 1 ha of native vegetation. Numerous canopy trees occur throughout the Study Area; these trees are likely to be utilised by

the Grey-headed Flying fox as food when the dominant eucalypts are in flower. It is expected that the construction of the cycleway will only remove understory vegetation and small trees.

The Proposal would thus not significantly reduce the extent of any Grey-headed Flying-fox foraging or sheltering opportunities, nor would it result in the erection of any barriers to the dispersal, foraging or interbreeding needs of this species. As such, the viability of the local Grey-headed Flying-fox population would not be adversely affected thereby resulting in the local extinction of this species.

(b) *"…in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction…",*

An 'endangered population' is defined as a "population specified in Part 2 of Schedule 1" of the *TSC Act.* Therefore the Grey-headed Flying-fox is not an endangered population.

(c) *"…in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction..."

An Endangered Ecological Community means an ecological community specified in Part 3 of Schedule 1 of the *TSC Act*. The Grey-headed Flying-fox is not listed as an Endangered Ecological Community.

(d) *"…in relation to the habitat of a threatened species, population or ecological community:*

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed…", and

The vegetation likely to be removed or impacted within the Study Area (<1ha) may offer some foraging opportunities for the Grey-headed Flying-fox when the local eucalypts are flower. Whilst this is the case, the vegetation within the Study Area is part of the larger Cattai Creek riparian vegetation. Other areas of foraging habitat may also be found in local parks and reserves, in private gardens and streetscapes. The removal of less than 1 ha of foraging habitat within the Study Area is not considered to be significant in the contact of the Locality and Region.

(ii) "… whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action…", and

The Grey-headed Flying-fox is known to easily negotiate urban infrastructure, including urban areas, roads, open fields, water bodies and paddocks. When eucalyptus trees are flowering, the Flying-fox is known to traverse long distances in search of food. The disruption of less than 1 ha of native vegetation within the Study Area would not present a barrier to the movement patterns of this species such that any of its habitat areas are likely to become isolated.

(iii) "…the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality…"

The vegetation proposed to be impacted (<1 ha) would not be important for the long-term survival of the Grey-headed Flying-fox. Adjacent to the Study Area, in parks and reserves, in local properties, in the nearby western creekline and gully, and throughout the Locality and Region, numerous stands of similar trees are present, these providing foraging opportunities for this species, thereby guaranteeing the long-term presence of the Grey-headed Flying-fox.

(e) *"…whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)…"*

No critical habitat would be adversely affected by the Proposal. The Study Area and Locality are not listed as critical habitat under Part 3, Division 1 of the *TSC Act*. Critical habitat for the Grey-headed Flying-fox is yet to be defined.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A Draft National Recovery Plan has been prepared for the Grey-headed Flying-fox (DECCW 2009).

The following objective is relevant to this Proposal: to identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range. However, given the very small amount of habitat likely to be disturbed by the cycleway construction (<1ha), it is highly unlikely that this stand of vegetation would be identified as a priority foraging area.

(g) ..whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Currently 27 Key Threatening Processes for mainland NSW are listed under Schedule 3 of the *TSC Act*. Of these, "clearing of native vegetation" would be applicable to the Proposal. Whilst it is acknowledged that the cycleway construction would impact less than 1 ha of native bushland, it is not considered that this impact, would result in a significant loss of habitat for this species from the Locality or Region.

The effects of other key threatening processes such as the introduction and spread of weeds such as Lantana, exotic vines, perennial grasses, vines and scramblers should be kept to a minimum.

It is recommended that the largest possible area of bushland within the Study Area remains undisturbed to minimise the impact of key threatening processes.

Expected impact on the Grey-headed Flying-fox

The cycleway construction is not considered to have a significant impact on the local status of the Grey-headed Flying-fox. The works would not remove any significant portions of this species' roosting or breeding sites and no *major* foraging areas would be significantly affected. The works would not present a barrier to the dispersing or movement patterns of this species, the Grey-headed

Flying-fox expected to easily negotiate those environments present within the Study Area and Locality generally.

It is not considered that the proposed construction of a cycleway between Linksley Avenue and Rosebery Road would have a significant impact on the Grey-headed Flying-fox, its populations or habitats. Therefore, the preparation of a Species Impact Statement that further considers the impacts of the Cycleway Link on these species is NOT REQUIRED.